Science Education

The Official Organ of the National Association for Research in Science Teaching, the National Council on Elementary Science, and the Science Association of the Middle States

Volume 24 JANUARY, 1940 Number 1

Published seven times a year in October, November, December, January, February, March, and April by SCIENCE EDUCATION, Inc.

Publication Office: 374 Broadway, Albany, N. Y. Subscription price: $2.50 a year; $3.50 in foreign countries. Single copies, 50 cents. 65 cents in foreign countries.

Application for change of second-class entry from Lancaster, Pa., to Albany, N. Y., pending.

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Volume 24 **JANUARY, 1940** **Number 1**

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PUBLISHED BY
SCIENCE EDUCATION, INCORPORATED

Communications regarding manuscripts should be sent to the Editor, Science Education, 374 Broadway, Albany, N. Y., or 32 Washington Place, New York City. Major articles should be no longer than 3,000 words; classroom notes should be limited to 500 words. "Suggestions to Authors" will be sent upon request.

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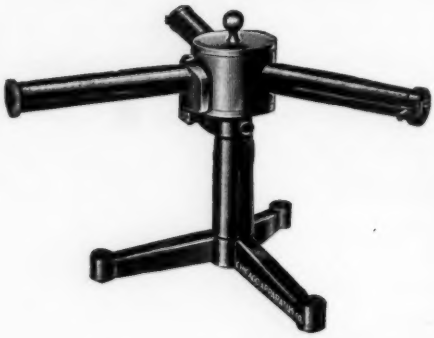

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Science Education

DEVELOPING CONCEPTS AND ATTITUDES OF TIME AND CHANGE THROUGH ORGANIZED ACTIVITIES

LEE R. YOTHERS
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During recent years, there has been an increased tendency to place greater emphasis on the development of student attitudes with regard to: a concept of time; changeable aspects of the earth's surface; how plants and animals have and are changing; and the agencies which operate to produce these changes.

Many biology and general science teachers now include in their course of instruction a unit dealing with this division of scientific knowledge.

Not infrequently, however, we encounter instructors, who, with the exception of teaching about fossils, ignore this problem. These teachers feel that, without suitable evidence, the presentation would be an abstract one. As a consequence, students would be hampered in understanding the objectives to be sought. Likewise, it is difficult to arouse interest concerning the changing earth without concrete material, which may be observed and studied.

It is true that the average junior and senior high school students' reaction will be richer when activities enter into the enterprise. If, therefore, they are to make real progress in understanding this phase of science, an abstract approach is not the most desirable one.

During the past several years, the author has collected illustrative material and organized activities, which, it is believed, add student interest and scientific significance to this study. The substance of this article, therefore, is to present a resumé of the broad frame of topics used, with a description of the supplementary activities and demonstration material accompanying each phase of the sequence.

This body of material includes the following: a geological time table, demonstrations, newspaper and magazine articles, books, pictures, models, Indian relics, fossils, statistics and local evidence of change. The major guiding factors in making their selection were the accepted dominant objectives manifested in textbooks and professional magazines.

A glance at the list of ensuing topics will indicate familiar problems of this subject welded into a unit. An attempt has been made to illustrate them in such a manner, that, at their conclusion, the student may carry a concept of how the elements, time and change, always produce a variable earth and population. The students' permanent gain should be a recognition of the fact that change is inevitable, and they should have some appreciation of the completeness with which these factors ramify various phases of life.

A description of the program follows:

GEOLOGICAL TIME TABLE

One's concept of time may be broadened by a thorough comprehension of the geological time table. To achieve this objective, students are frequently given the opportunity to refer to this table. This is made possible through mimeograph copies of a conventional form, prepared in sufficient number to permit individual ownership. The time table is studied and

discussed with the view to noting: (a) the eras and periods, their beginning, duration and end. Students write the years on their chart, (b) the rise and decline of plant and animal species, (c) which plant and animal species are descendants from prehistoric species. In this connection, a few individual examples are given, but, in the main, groups are considered, and (d) the scientific facts upon which the time table is based.

Having provided a suitable background for interpreting the major features of the time table, the students will, as the unit progresses, write on their charts, in the appropriate period, the name of the prehistoric plant or animal studied. They will indicate, also, when the species came into existence, the span of existence, and when it became extinct.

When completed, they are in possession of a chart providing important geological facts of the plant or animal studied. This procedure enables them to compound their ideas of living things of to-day with those of past years.

Fossils

An attempt to develop in a pupil's mind, attitudes, and concepts, concerning changes on the earth, without a credible display of fossils, is unthinkable. They represent the core to this understanding. In fact, we cannot fully understand living plants and animals without knowing their ancient ancestors—now in fossil form.

An adequate assemblage of fossils may be procured through the following sources: (a) local expeditions by the teacher, (b) student assistance, and (c) purchased specimens.

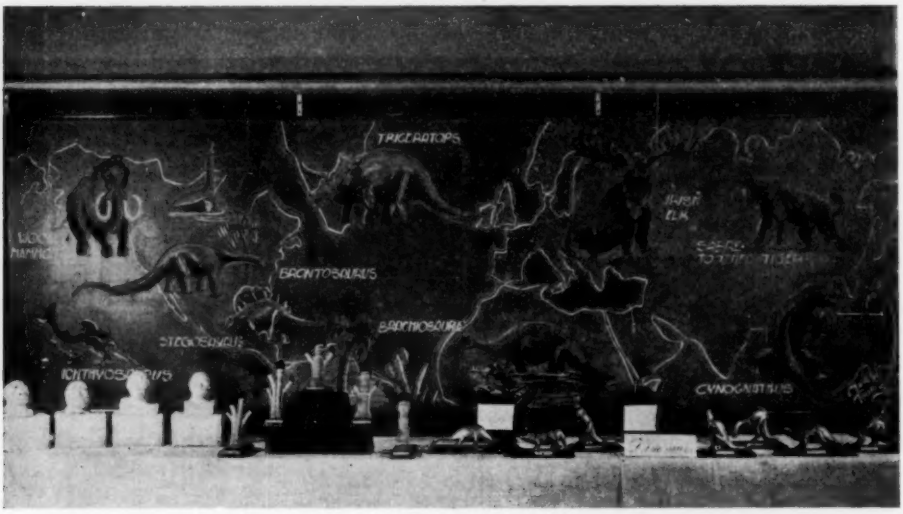

FIGURE 1

It is an excellent habit to train one's self to examine rocks wherever one finds them. This habit has netted the writer a few excellent fossils (Fig. 2). When collecting fossils, it is good policy to keep every specimen which is found, irrespective of the state of condition or the number on hand. The better specimens may be retained for permanent display, while the others may be used for classroom study.

There are many types of fossils which cannot be collected locally. Inexpensive and fully labelled sets may be purchased.

In addition to inviting interested students to accompany him on local fossil hunting hikes, the teacher may encourage pupils, who vacation in a region where fossils are prevalent, to find them and contribute to the department's supply.

When studying fossils, however, there is one danger, which must be carefully guarded against. In their eagerness to observe fossils, students are likely to fail to associate them with life of the past, and, without directed assistance, they do not see them as the ancestors of present day life.

A brief summary of our procedure for studying fossils follows: the collection is divided into two groups; namely, one group, consisting of the better specimens, is used for permanent display; the other group, including duplicates and the inferior specimens, is used for class activities.

To introduce this subject, the better specimens are placed on the laboratory tables. Accompanying each fossil is a labelled paper denoting the following information: the name, where it was found and the period when the species first made its appearance, dominated and finally became extinct. Students move freely from table to table to examine the specimens. These facts are recorded on their geological time tables.

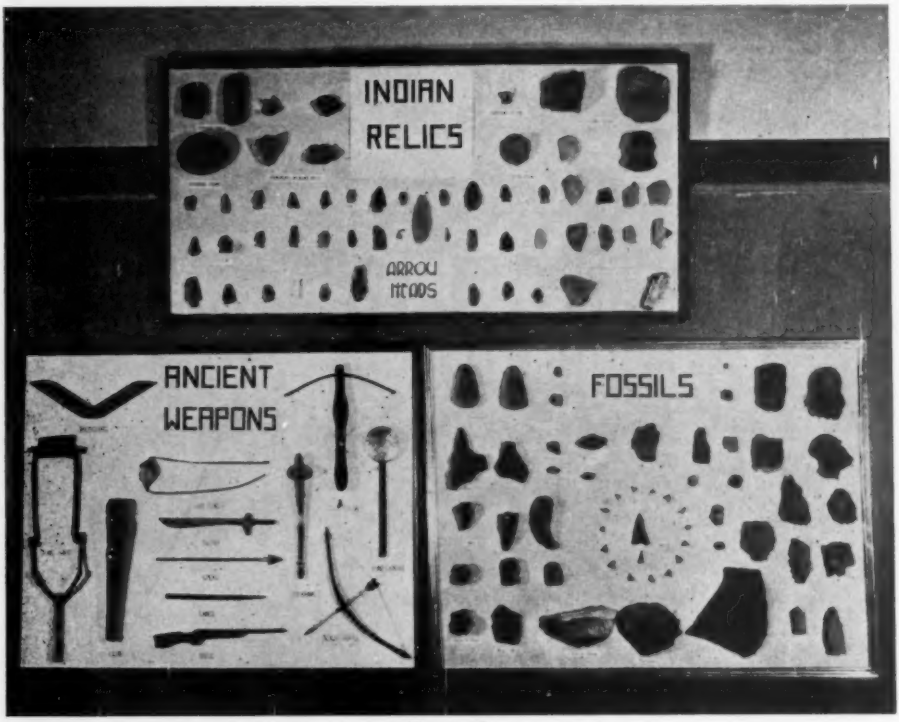

FIGURE 2

With this acquaintance for a foundation, a class discussion is centered about the following topics: paleontology, rocks, how fossils were formed, where found, expeditions, necessary tools for working with fossils, etc.

Following this discussion, several tables are heavily padded with cloth, paper and boards. Hammers and cold chisels are issued to the students, who remove and

examine the fossils from the inferior specimens.

Forefoot of the Horse

The models shown in Figure 1 are replicas depicting the evolution of the forefoot of the horse. They were carved from white pine by a boy whom I had both the pleasure and privilege of teaching biology. Owing to his skill and good spirit of cooperation, my course has been greatly enriched by the many fine models which he carved.

In this series, reading from left to right, are representations of the forefoot of the following horses: (1) Eohippus, (2) Orohippus, (3) Mesohippus, (4) Hipparion, and (5) Equus.

It is hardly necessary to point out the value of these models when we study the evolution of the horse, nor need emphasis be placed on the interest they add to the study.

Dinosaurs

In addition to their contribution as a valuable aid to understanding life of the past, the study of dinosaurs can be a lively one, especially, when such excellently carved models as those shown in Figure 1 are available. The writer recalls the reaction of his students when this subject was taught, using pictures for illustrations. It was, indeed, disquieting to be confronted by pictures and a maze of scientific names.

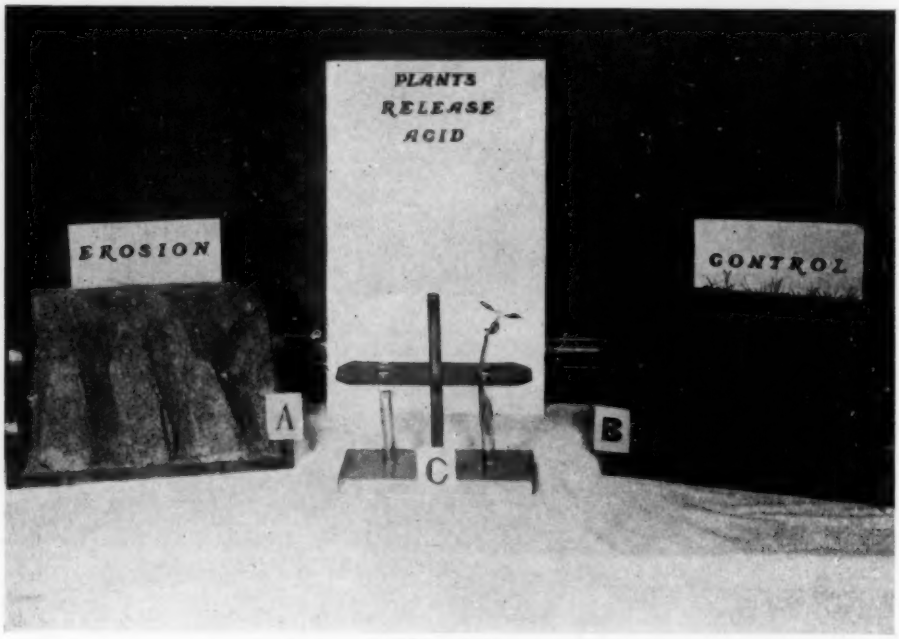

FIGURE 3

When a model is displayed, every eye in the room is concentrated upon it, and each mind is in a receptive frame to hear the facts concerning the animal whose replica is before them.

Obviously, a skilled woodcarver is not enrolled in every class, but good models may be made from clay or plaster of Paris. The Art department may be glad to cooperate with the Science department in a project of this kind.

Extinct Birds

We include in this unit a study of extinct birds. Both ancient and recently extinct examples are considered. Two birds are illustrated; namely, the Dodo and the Moa. In Figure 1, may be seen the models, which were carved from balsam wood, then painted appropriate colors. This project was the work of a girl.

Evolution of Man

In addition to using pictures to illustrate this phase of the unit, the heads (Fig. 1) were moulded from plaster of Paris, by female students, who were enrolled in Art as well as Biology.

Changing Culture Patterns

Human biology should not be concerned solely with a description of organ systems and their functions. A survey of some sociological aspects of man, as culture change and attendant lag, have a place in the science-learning processes. This may be made a particular objective in a unit designed to make youth conscious of change. Even though briefly presented, a few carefully planned principles basic to a general knowledge of culture change become a source of useful training to young people.

Occasionally, a student may be interested in a specific phase of a culture pattern of the past. To kindle his interest and to provide a more adequate understanding of this field, he should be encouraged to express his interest in a concrete manner, as did the boy who constructed the replicas of ancient weapons (Fig. 2).

The culture pattern of the early American Indian is one of the most colorful to describe. Furthermore, it is quite a contrast to the contemporary culture of the white man. The writer had the advantage of living near an Indian Reservation and was able to secure some first hand information about them, and, in addition, some of their primitive tools (Fig. 2). These facts are germane for introducing early manifestations of culture. They represent primitive men fashioning their culture about the natural environment.

Boys and girls are interested in this culture pattern. They will secure library books about Indians and spend considerable time reading them. Likewise, going singly or in groups, they will devote hours, looking for relics and feel well repaid for their effort if a single arrow-head or a stone tool is found. Such interest may be made to serve a useful end.

Following this, a more highly developed culture of a people in our time may be undertaken for study.

EXTINCT AND NEAR EXTINCT ORGANISMS

When assigning this study, a class is organized into eight committees; each committee being directed by a chairman, who will aid in finding and tabulating the desired information for the completion of one chart.

Individuals associate themselves with a group in accordance with their interest for a particular study. Ample time is allowed for assembling this material, and on a day designated the chairman for each committee presents the results of his study to the class. The reports are given slowly, thus, enabling every member of the class to tabulate the information on his chart.

To assist in recording and retaining for future reference the data obtained, mimeograph forms of the charts, which follow, are prepared and issued for personal possession.

CHART I. EXTINCT ANIMALS

Animal	When Extinct	Geographical Habitat	Probable or Actual Cause of Extinction

CHART II. ANIMALS IN DANGER OF EXTINCTION

Animal	Geographical Habitat	Reason for this Situation and Preservation Efforts

CHART III. EXTINCT ANIMALS OF NEW JERSEY

Animal	Cause of Extinction

CHART IV. NEW JERSEY ANIMALS LIABLE TO EXTINCTION

Animal	Conservation Efforts: as, education, laws, etc.

Duplicate blanks of the charts are prepared. There is one difference, however: they relate to a specific examination of the plant situation.

DEMONSTRATING AGENCIES WHICH CHANGE THE EARTH

The study of agencies which affect change on the earth may be enhanced by a few well chosen activities in the laboratory. Such demonstrations, however, should not be considered substitutes for actual examples. Whenever possible, real situations should be included. For example, the result of water erosion may be noticed in almost any community, and the process can be shown on a minor scale in the laboratory, along with a control. The work of agencies as: wind erosion, temperature, acid and pressure are not so readily seen, particularly by students who, perhaps, see the open country from fast moving automobiles.

As an aid for stimulating thought and developing an understanding of these forces, the following demonstrations are conducted in the laboratory:

1. *Erosion.* To feature erosion, two boxes of equal dimensions were constructed. A study of Figure 3, A and B will indicate how the boxes were assembled. The dimensions may be of any convenient size. The boxes were stained, given two coats of varnish and waxed to prevent warping. When ready for use, they were filled with well packed soil.

(a) *Wind erosion.* To illustrate this, box "A" was placed on a table. A large white sheet of cloth was dampened and suspended in a vertical manner in back of the box. An artificial wind, supplied by an electric fan, was directed against the soil. This continued until definite soil deposits were in evidence on the cloth. Dry soil facilitates this experiment.

Next in procedure, was a discussion of the accounts of our recent dust storms of the West. A large map of the United States was used to locate the principle States which were affected. Pictures, found in books and newspapers, add vividness to the story.

(b) *Water erosion.* Our plan in this experiment included a method of controling this phase of erosion. Details of the activity included the following features: The soil in box "A" contained no surface covering, while in box "B", three strips of turf, each about two inches wide were embedded in the soil. In turn, each box was placed under a water spray of even pressure for the same length of time. The state of the soil in the boxes was then compared. The canyon effect (Fig. 3A) may be more easily and quickly obtained if the soil surface is uneven.

When this experiment is performed indoors, provision should be made to prevent as much soil as possible from going down the drain.

A United States map, pictures, statistics, and local evidence of water erosion may be included in the study.

2. *Acid.* This experiment presents evidence that root hairs release acid which assists in dissolving minerals, and as a result, act as an agent which produces change on the earth. First, show the

action of a base and an acid on a solution of phenolphthalein in water. In a beaker prepare another solution of phenolphthalein in water, adding ammonium hydroxide, one drop at a time, until the desired color is obtained. Pour equal amounts of this solution into two test tubes. The one tube may act as a control, while, into the other tube, place the roots of a vigorously growing bean plant (Fig. 3C). Eventually the color change, in the tube containing the plant, will be sufficiently pronounced to be significant.

3. *Temperature.* Students easily recognize the capability of temperature to produce changes on the earth, after viewing the startling results of rapid molecular agitation of a stone, through temperature change. To demonstrate this, heat a small stone, then plunge it into water chilled by ice cubes.

Many common laboratory experiments showing expansion and contraction of liquids, solids and gases, resulting from temperature change, are applicable for illustrating this phase.

4. *Pressure.* This force, as an agent of change, may be shown by rubbing together sedimentary stones. Stones possessing varying degrees of hardness may be used for comparison.

Newspaper and textbook accounts of landslides, glaciers, volcanoes, earthquakes, etc., may form a basis for class study and discussion for understanding pressure and its effect.

This study terminates the organized unit, except for a general summation of the unit as a whole.

A COMMON SENSE INTERPRETATION OF ATTITUDES IN SCIENCE INSTRUCTION

A. W. HURD
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The matter of inculcating attitudes in school instruction has been prominent in the minds of progressive educators for a long time. They have realized that the knowledge gained from many school courses is soon forgotten. School test records show indeed that much of the knowledge we assume that pupils gain is never actually gained by the great majority. Unless there have been certain attitudes which pupils have acquired, we have little excuse for compulsory school attendance on the part of a large fraction of the school population after a fair degree of skill in the use of the tool subjects has been acquired. Some authorities have pointed out that many pupils who are compelled to attend school longer than they desire, acquire undesirable attitudes, such as inferiority feelings, with the accompanying timidity reactions, hate for academic studies and teachers who teach them, enmity toward the school, and the like.

The difficulties in the way of a direct attack on the problem of developing specific attitudes have been due to (1) the inertia resisting changes in our conventional school curricula, and (2) a lack of a clear understanding of what attitudes are and how to develop them. It is obvious that definitions of some aspects of desirable attitudes, and planned school experimentation to develop them, will hasten a solution of the problems associated with attitudes. Data secured by the writer[1] show a distinct consensus of opinion among science teachers in teachers' colleges and high

[1] A. W. Hurd. "How Shall Science Instruction Be Organized?" *Science Education* 18: 106-111; 1934.

schools stressing the fundamental importance of attitudes in science instruction. The major task is to define some of the attitudes, plan devices to measure their acquisition, and formulate acceptable instructional units for experimental use in schools chosen to cooperate in the experimentation.

Some of the confusion regarding attitudes arises from attempts of psychologists to explain them basically in the mechanism of the human mind and body. From the psychologists' standpoint, we know little about the causes of the basic activities of the human mind in an ultimate sense. This should not dishearten us, however, in our attempts to develop attitudes in school children. From the same viewpoint, we know little about the underlying causes of learning, itself. In practice, we do things which have certain obvious outcomes, and, for the time, we do not try to explain them from an ultimate cause and effect standpoint. We know that we can teach people to spell, read, write, add, multiply, and so on. These are practical and useful skills. We do not know the ultimate underlying mechanistic, chemical, or electrical processes which bring all these things about.

It seems that we may attack the problems of attitudes in somewhat the same common sense manner as we do those of spelling, reading, and the arithmetic skills, if we can make certain aspects of attitudes identifiable in our minds. An attitude has been variously defined as "position or bearing indicating action, feeling, or mood"; "the subjective aspects of adjustment or behavior"; "acquired motivation-patterns"; "organic drives, purposes, or motives"; "muscular adjustment"; "generalized conduct"; "neural set or readiness to adjust"; "emotional responses"; "feelings"; "verbal accepting or rejecting responses"; "tendency to act"; "behavior integrations associated with signs and symbols of probable behavior"; "habits of thinking"; and so on. These are useful definitions but they do not make specific attitudes identifiable for instructional purposes.

The writer has felt for some time that there is great necessity for making attitudes specific, that there are many common words in use in our language which indicate specific attitudes which are fairly well understood. The word, experimental, may be used to illustrate this conception. A person who has an experimental attitude toward problem solution is one who wishes to try out some hypothesis and see whether it holds as an explanation for the problematic difficulty. He may concentrate on experiments so long that he turns immediately to the possibility of an experiment whenever he has a problem to solve. This gives proof of the experimental attitude.

How many of our common words used extensively in everyday life imply attitudes? The writer recently canvassed Webster's Collegiate Dictionary and quickly found 531 common adjectives helping to define certain attitudes. Later he checked those which seemed to classify particularly under scientific, i.e. associated with the study of science. This classification might be further refined. But the important point is not to know that an attitude is a scientific attitude so much as to identify it in behavior and decide whether it is undesirable or desirable in specific situations. Table I gives the adjectives selected from the dictionary and checked as pertaining to the scientific. There is some overlapping among the terms but this is relatively unimportant. The important considerations are: Do we know what these imply? Can we tell when they apply? What behavior gives proof of each implied attitude? When are these behaviors desirable? To what extent are they desirable under different conditions?

In order to exemplify the experimental attitude, we may formulate an instructional unit and try it out in a science class, for example. We may even restrict ourselves to generally recognized science content in this unit but, obviously, if we wish to have

TABLE I

ADJECTIVES SPECIFYING CERTAIN ATTITUDES ASSOCIATED WITH SCIENCE

1. bigoted	22. deliberative
2. honest	23. heretical
3. analytic	24. arrogant
4. observant	25. logical
5. deceptive	26. obstinate
6. careful	27. opinionated
7. negligent	28. persevering
8. thoughtful	29. persistent
9. credulous	30. progressive
10. critical	31. adventurous
11. judicious	32. reflective
12. disciplined	33. research
13. deceitful	34. resourceful
14. emotional	35. resolute
15. erratic	36. diligent
16. unprejudiced	37. speculative
17. impartial	38. studious
18. unbiased	39. teachable
19. fair-minded	40. tolerant
20. sincere	41. tyrannical
21. irrational	42. truthful

pupils generalize an attitude, it would be essential to introduce situations and associated content from many other fields. Take the word, bigoted, for example. A bigoted person, according to the dictionary is one who is "obstinately and blindly attached to some creed, opinion, practice, ritual, or the like; illiberal toward others' opinions." Synonyms are, "prejudiced, intolerant, narrow-minded." An examination of the list in Table I discloses the words, "unprejudiced, fair-minded, opinionated, and tolerant," involving this concept of bigotry. A person who is distinctly prejudiced, opinionated, intolerant, and unfair-minded is distinctly a bigoted person. It is obvious that a person may be bigoted on a certain question, or on a few questions, and not on all. This may explain why some scientists, for example, may have exhibited a totally unprejudiced and unbigoted attitude toward their special vocational fields of work, and yet be quite bigoted in other fields. For identification purposes in its positive aspects, this attitude may be called the fair-minded attitude.

The second word in the list is honest. Other words closely related to it are deceptive, deceitful, impartial, sincere, and truthful. These bear fairly well understood connotations. If we remember to judge the attitude in connection with the specific situation, we can agree quite well on whether an attitude is honest, impartial, sincere, truthful, deceptive, or deceitful. The person who is endeavoring to discover the relationship between barometer reading and temperature, for example, will not succeed if he is dishonest, insincere, deceitful, or deceptive in his observations. The negative phase of this attitude implies deliberative falsification of fact for some ulterior purpose, ignoring truth, logic, and reason. For identification purposes in its positive aspects, this attitude may be called the honest attitude.

Another combination from the list is: analytic, observant, critical, judicious, erratic, irrational, unbiased, emotional, deliberative, logical, intelligent, reflective, studious, thoughtful, credulous. An analytic attitude is one which must be observant, critical, judicious, unbiased, deliberative, logical, intelligent, reflective, studious, and thoughtful—not emotional, erratic, irrational, or credulous. It implies ability to recognize and weigh pertinent data and choose wisely among alternatives, to select the elements which go to make up the whole, without becoming confused over irrelevant data—not to jump at conclusions without having carefully considered all the facts which bear upon the question at issue. This analytic attitude contrasts well with the bigoted attitude. A superlatively analytic attitude is a certain eradicator of the bigoted attitude. A person may cease to be bigoted by analyzing the elements which combine to produce his bigotry. A credulous, irrational, and erratic person may easily become a bigoted one.

A fourth type of attitude involves the words careful, negligent, persevering, disciplined, persistent, resolute, and diligent. One who is careful must be persevering, persistent, resolute, and diligent—not negli-

gent. This might be called the painstaking attitude. It is the opposite of the careless and indifferent attitude.

A fifth type involves the words heretical, arrogant, obstinate, teachable, and tyrannical. This might be called the coöperative attitude in its positive aspects. It is somewhat related to the honest attitude in that there is a desire to learn and see the truth. The negative aspects, however, infer obstinacy and the lack of a desire to coöperate.

A sixth list includes progressive, adventurous, research, resourseful, and speculative. This attitude implies dissatisfaction with the present stage of achievement. The person who has it must have some creative imagination which visions new and different conditions which give promise of life on a higher level. He wishes to press forward toward that higher level.

And so we might go on and collect a longer list of adjectives which might imply other attitudes. The fact which we must face, however, is that there are shades of meaning in each word which make it distinguishable from all the others. It would seem that a reasonable basis for developing attitudes would rest on a study of the numerous word meanings. The scientific attitude can never be a unitary thing, and it is wise to recognize this. But there are desirable attitudes and undesirable attitudes under specific conditions which may be recognized.

The somewhat rough classifications formulated from the original list compiled may help us in developing instructional units, however. For purposes of accomplishing most in relatively small times for instruction, we may helpfully think of the six types synthesized, viz., (1) the fair-minded attitude, (2) the honest attitude, (3) the analytic attitude, (4) the painstaking attitude, (5) the coöperative attitude, and (6) the progressive attitude. The first four may probably be most closely identified with those named by other writers although the sixth undoubtedly supplies the fundamental motive which impels many scientific investigators. The coöperative attitude is not commonly mentioned in lists of scientific attitudes. But, obviously, it is a desirable attitude to stimulate action on group projects where results are of paramount importance.

TEACHING SCIENCE TO DEFECTIVE DELINQUENTS

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Of what possible use can science teaching be to inmates of a state prison for mentally defective criminals? Could these subnormal individuals, convicted of infractions of the mores of society, find anything worthwhile in the study of science? Could these adult mental defectives possibly learn science? What kind of science could be taught without laboratory facilities, no equipment, and a yearly appropriation of only $40.00? So little is known about teaching science to adults, could one arrive at any practical solution in dealing with criminal mental defectives?

These were some of the problems facing the newly appointed science teacher to the Woodbourne Institution for Defective Delinquents almost two years ago, and this article represents the drawing up of a statement, a balancing of the ledger which may interest the reader.

Although we are learning more and more concerning the interests of children, little, if anything, is known of the interests of this group of adults with the minds of children but with the physical and emotional development of the adult. We can estimate the educational needs of children

based on the personal and social problems they face and their reactions to these problems. But we are just beginning to think about the particular personal problems of defective delinquents as evidenced by the establishment of the *Journal of Criminal Psychopathology*,[1] to analyze their personality defects and difficulties, and to attempt to illuminate and make understandable the social and economic conditions facing these men when they are released to take their place once more in the working world. At present our knowledge of the capacities of children is expanding rapidly, but we have scarcely begun to find out the mental capacity of these men with immature minds. How far can the defective delinquent enter into the study of science? Can he master the level of knowledge represented by the texts prepared for elementary school use, for the junior high school, for the senior high school? The writer does not pretend to have found any definite answer but in fumbling and experimenting during the past year and a half, some conclusions have been tentatively reached.

First, it is necessary to understand the treatment of crime by society and the possible importance of education before we can place science teaching in its proper and relative niche in penal education.

An individual who performs an act conflicting with the social mores is punished by the loss of property or the loss of personal liberty, or both, in proportion to the seriousness of his violation of the system of mores. Commonly, the loss of personal liberty for a specified time is the punishment exacted. A significant portion of the public believes the criminal must be kept behind bars and the longer, the better. They look upon the prison term as time spent for the expiation of a crime. But this attitude of revenge is not particularly helpful since almost all our prison inmates return to society. For its own protection, society must change the criminal to a more efficient citizen and re-adapt him to social life. The modern prison must prepare all its inmates against the day of their release.

A significant indication of our partial failure to change the criminal into a law-abiding citizen is the survey of 500 criminals made by the Gluecks.[2] They found that 80 per cent of the men released from the Massachusetts Reformatory had not reformed five to fifteen years after discharge, but had resumed their careers of crime. Punishment has not proven in the past centuries to be either permanent or efficacious in checking crime. If we could change the individual, society would be better protected.

In the past ten years, the trend of penology has been toward the increasing introduction of education as the primary means of bringing about desirable changes in the criminal with the view of transforming him into a right-thinking and right-acting member of society by helping him to solve his own problems and by changing undesirable attitudes.

A crime is not a single event but is symptomatic of a history extending to the childhood of the individual. Nor is the criminal merely an individual who violates the social code. He has a certain personality and a certain set of habits and attitudes resulting from his daily experiences. He comes from an environment in which he has experienced maladjustment, personal failure, and social uselessness.

When the criminal enters prison, his personality traits and ways of living have been long since set by his family, his playmates, the movies, the school and the neighborhood. As students, prisoners are inherently unpromising. They are the failures of social institutions and most have found school distasteful and left as soon as possible. They possess a background of

[1] First issue published, September, 1939, Woodbourne Institution for Defective Delinquents. Dr. V. C. Branham, editor.

[2] Glueck, Sheldon and Eleanor T. *500 Criminal Careers*. New York: Alfred A. Knopf, 1930.

repeated failure in school and the deep humiliation of having been compelled to associate with children younger than themselves in addition to being denied the opportunity of doing the things they like best. These conditions are even more evident among the inmates in Woodbourne Prison since they are mentally defective and have a long background of failure and uselessness. The average school grade by test in Woodbourne is 4.4.

In addition, the whole atmosphere of most prisons tends to breed bitterness and is conductive to the production of warped minds. Initiative and self-reliance tend to be discouraged in prison, and the inmate is taught to obey every order until in time he comes to wait for an order instead of acting on his own initiative. To overcome the deteriorating influences of prison life itself, inmates must be attracted by new interests and new outlets for their energies. The handicaps of inertia, indifference, resistance and antagonism are difficult to surmount. Education must build new habits of work and play more satisfying than the faulty behavior patterns that led to crime.

In prison education, the subject matter is not over important. The value and usefulness of education may be judged by the changes of inmate character and the adjustment of disturbed personality; by the contributions to improved social and personal attitudes and more desirable patterns of social behavior. Our educational objectives and procedures are interpreted in the light of normal life goals and in terms of personal experience and social participation. We must aim toward developing a feeling of individual success, no matter how handicapped the inmate may be, in order to make him sense that he is part of a social group requiring his services and respecting his particular abilities. All this is accomplished through teaching which deals with problems and situations that are socially important and individually significant, making considerable demand upon the mental capacity of each inmate, discovering and building upon that in which he can be successful.

We are trying to encourage both self-expression and the discipline of self-control for the good of others; to help the inmate not only express himself in work and play through individual effort but also in wholesome fellowship with others in group activities. These are the prerequisites for happiness and efficiency. Habits of fair play, honesty, self-reliance, and cooperation can be built in concrete situations in the classroom.

The course of study in science is not limited by the fact that the average mental age of the inmate is 9.5. We have found that if the subject matter appeals to and has practical value for them, the inmates may adequately master the contents of the usual general science course. Having secured the inmate's interest, he is given opportunity to use his imagination, to recall facts previously learned, and to apply them to the solution of a new problem.

We have found that whatever interest attaches to science must be evoked immediately, if at all. Our students are interested in things that affect their daily lives, health, homes and work. The snake pen, the birth and care of newly born garter snakes, the aquaria were some of the stimuli used to arouse interest in the study of living things. As one inmate said, he was interested in doing "real experiments, doing something worthwhile." Another inmate stated that he "wants to learn something about animals because it satisfies me."

Although in reasoning, judgment, resourcefulness and initiative, the mental defective differs most markedly from the mentally normal, yet in interest and ability in motor activities, and in dealing with ideas concerned with concrete materials, he approaches, and in many cases, surpasses the average. Through the use of home materials, 5 and 10¢ store purchases, equip-

ment found in the institution or constructed by members of the science classes who work in the various shops, and simple experiments, the direct association between concrete material and abstract symbols was made possible to an unsuspecting degree. The microscopic examination of green life, the study of molds, the circulation of blood in a frog's foot were tremendously exciting to the students. It was stimulating to see how the faces of these men lit up when they entered the classroom, how eagerness and interest replaced dull apathy and self-withdrawal. They were anxious to see things, observe for themselves and even to think for themselves.

In the summer, the study of living plants and animals, the collection of animals, insects and leaves formed the material for the development of scientific concepts and principles. In fact, some guards complained that a number of the men on the maintenance gangs seemed to be "nuts." All they seemed to be interested in was collecting animals and plants for the science class. The study of seeds and flowers, the functions of the various parts of the plant and the study of plant reproduction were eagerly engaged in. During the past year and a half, other units such as electricity and magnetism, air, water, weather, foods, heating and cooling methods, machines and energy, the disposal of wastes, transportation, communication and the development of man were all studied in the science classes.

Throughout, the content was correlated with the common experiences of the students. Opportunities were always presented for the application of the knowledge during its very acquisition and to divide the work into individual assignments in such a way as to provide sufficient related activities for full participation by every student, thus making for sustained concentration, observation and concrete application. Each student reported to the entire class on the individual work completed, in this way offering opportunity for self-initiative, self-expression and group cooperation.

Since the reading ability of the students varies from the fourth grade to the ninth, individual tutors were selected for those students having great reading difficulties. Expression through written English was encouraged by means of requested reports and the description of experiments performed. However, in the study of printed materials, the saturation point of the mental defective is quickly reached with attendant loss of interest and effort. Therefore reading was minimized except for those particularly anxious to read. Yet books and articles in simple English dealing with the lives of such great scientists as Galileo, Faraday and Pasteur were found fascinating by the students. The problems and the experiments in the science units, the method of class organization described, created a practical need for the use of the tool subjects—spoken and written English, reading for information and pleasure and the simple fundamentals of arithmetic.

The science classes functioning at Woodbourne may be judged successful at least to some degree from the favorable comments of some guards who are in contact with the students for a long period of time during the day. The interest, the enthusiasm, the appearance of vitality and the purposeful activity impressed them deeply. The simple, unaffected pleasure of finding out things for oneself, the manipulation of materials, the learning situations so controlled as to permit achievement with reasonable success leading to a sense of confidence and security so essential to wholesome personality changes, were all influential in fostering the development of attitudes and habits that function properly in life situations. The atmosphere of the class was purposefully engendered to help develop self-respect in these perpetually failing individuals as well as habits of working with others, of taking part in

cooperative problems and of giving and winning approval. Each student was encouraged to ask questions, to make suggestions and to try things out. All this helped to build the kind of environment in which the student was encouraged to give the best in him and to realize that he has some worthy contributions to make, however small. The science classes have aimed to make the inmates walk larger in a large world; to develop an understanding of how people live together; how activities are carried out in the community for the benefit of the group rather than the individual; the satisfaction of curiosity about themselves and the world about them.

A COMPARISON OF THE GROWTH OF SURVEY COURSES IN PHYSICAL SCIENCE IN HIGH SCHOOLS AND IN COLLEGES

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INTRODUCTION

Within recent years a decided tendency has been evident to introduce courses in both colleges and high schools that make an effort at the fusion of two or more of the traditional physical sciences and result in a course of the survey type. Although these courses have developed on both levels, the majority of the studies of such courses have dealt only with those in the colleges. In order to compare the courses on these two levels and determine their relative status and trends a study of the whole physical science survey movement was completed recently.

NUMBER AND DISTRIBUTION OF COURSES IN COLLEGES

Several studies have been reported in which a sampling was made to estimate the number of such physical science courses in colleges. To give as exact a picture as possible the present study was planned to include catalogues of nearly all of the colleges in the United States. The 1939 Directory of the United States Office of Education lists 1,440 colleges exclusive of technical and professional schools. Catalogues from 1,239 of these institutions were examined and the results classified under five types of colleges. These data are shown in Table I. Only catalogues for 1937–8, or 1938–9, were examined and over 90 per cent of the total number were for the latter year.

Reference to the table shows that for each type of college over half of the schools listed were included in the study and in the cases of the liberal arts colleges and teachers colleges the figures represent better than 90 per cent of all such schools.

In addition to the courses of one quarter, or longer, that included only physical science, notation was made of two related types of courses. Those cases in which materials from both biological and physical science were fused in a single course were referred to as surveys of natural science. When courses were offered in separate departments but were intended to form a sequence in physical science and were not of more than one semester in length, they were listed as semi-survey courses in physical science. Part II of the table indicates the numbers of each of these types listed for the five groups of colleges.

It is evident that while most courses are found in the liberal arts colleges, the teachers colleges show the highest percentage of their group as making offerings. Semi-survey courses are confined largely to a

TABLE I

DISTRIBUTION OF THE NUMBER OF SURVEY OF PHYSICAL SCIENCE COURSES IN COLLEGES AS INDICATED BY THEIR CATALOGUES

	Liberal Arts		Teachers Colleges		Normal Schools		Junior Colleges		Negro Colleges		All Colleges	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Catalogues listed	659	100	169	100	61	100	442	100	109	100	1440	100
Part I. *Catalogues Examined*												
1938–9	571	86.9	151	89.4	32	52.5	319	72.3	63	57.8	1136	78.9
1937–8	61	9.3	4	2.4	2	3.3	30	6.8	6	5.5	103	7.2
Total	632	96.2	155	91.8	34	55.8	349	79.1	69	63.3	1239	86.1
Part II. *Courses Offered According to Catalogues*												
Survey of physical science	88	13.9	83	53.6	19	56.0	54	15.5	19	27.5	263	21.2
Survey of natural science	36	5.7	27	17.4	3	8.8	26	7.5	9	13.0	101	8.2
Semi-survey of physical science	19	3.0	3	1.9	0	0.0	1	.3	0	0.0	23	18.6
Total	143	22.6	113	73.0	22	64.8	81	23.2	28	40.5	387	31.2
Part III. *Estimated Number of Courses in Colleges*												
Survey of physical science	83	12.6	81	47.9	31	50.9	61	13.8	27	24.8	283	19.6
Survey of natural science	34	5.2	26	15.4	4	6.6	29	6.6	12	11.0	105	7.3
Semi-survey of physical science	18	2.7	3	1.8	0	0.0	1	.2	0	0.0	22	1.5
Total	135	20.5	110	65.1	35	57.4	91	20.6	39	35.8	410	28.5

few liberal arts colleges. In all types of colleges the physical science survey seemed the most popular course of the three. When contrasted with results of a few years ago, this indicates that the physical science course is increasing at the expense of the natural science type of offering.[1] In the total group of 1,239 schools there were 31.2 per cent that listed one of the three types of course.

From the returns of questionnaires from 150 of the schools listing the physical science courses, it was found that about 11.3 per cent of the colleges failed to offer the course in 1938–9, even though it was listed in the catalogue. Part III of Table I

[1] Johnson, B. Lamar. *What About Survey Courses?* New York: Henry Holt Co., 1937. p. 10.

shows the results of extrapolating previous figures to 100 per cent for each type of college and then correcting the estimate for the padding of catalogues. The results show that nearly one fifth of all colleges were offering a survey of physical science courses in 1938–9 and 28.5 per cent, or 410 schools, were estimated to be offering some type of fused course containing physical science materials.

lation resulted in 250 replies as to the existence of fused physical science courses in their high schools on the levels above the ninth grade. Data by states are presented in Table III. These represent 42 states and the District of Columbia. A total of 54 cities, or 21.6 per cent, replied that they did offer such a course in at least one high school. The greatest number of such courses was in Los Angeles where 27

TABLE II

DISTRIBUTION OF SURVEY COURSES IN PHYSICAL SCIENCE AMONG MEN'S COLLEGES, WOMEN'S COLLEGES, AND COEDUCATIONAL COLLEGES AS INDICATED BY THEIR CATALOGUES

Type of College		Men's Colleges		Women's Colleges		Coeducational Colleges		All Colleges	
		Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Liberal Arts	Offered	5	4.6	11	7.6	64	17.0	80	12.7
	Not offered	103	95.4	134	92.4	315	83.0	552	87.3
	Total	108	100.0	145	100.0	379	100.0	632	100.0
Teachers Colleges	Offered	0	0.0	3	42.9	78	52.7	81	52.3
	Not offered	0	0.0	4	57.1	70	47.3	74	47.7
	Total	0	0.0	7	100.0	148	100.0	155	100.0
Normal Schools	Offered	0	0.0	1	33.3	18	58.1	19	55.9
	Not offered	0	0.0	2	66.6	13	44.9	15	44.1
	Total	0	0.0	3	100.0	31	100.0	34	100.0
Junior Colleges	Offered	5	22.8	2	2.6	40	15.9	47	13.5
	Not offered	17	77.2	74	97.4	211	84.1	302	86.5
	Total	22	100.0	76	100.0	251	100.0	349	100.0
Negro Colleges	Offered	0	0.0	0	0.0	19	29.2	19	27.6
	Not offered	2	100.0	2	100.0	46	70.8	50	72.4
	Total	2	100.0	2	100.0	65	100.0	69	100.0

Table II indicates the distribution within each type of college for the number of physical science survey courses in men's colleges, women's colleges, and coeducational colleges. Except for the men's junior colleges, coeducational schools far outrank the other groups in the per cent that offer physical science survey courses.

NUMBER AND DISTRIBUTION OF COURSES IN HIGH SCHOOLS

A post card inquiry send to the 357 cities in the United States of over 25,000 popu-

high schools offered 90 classes in a fused course in physical science.

Of the states making frequent replies California had the highest per cent of courses, with 46.7 per cent of the cities studied offering a course. A further study of all high schools in this state resulted in the discovery that 116 out of 406 high schools in the state offered a fused physical science course in 1938–9 on a level above the ninth grade. This represents 28.5 per cent of all high schools in the

TABLE III

DISTRIBUTION BY STATES OF CITIES OF OVER 25,000 POPULATION THAT OFFERED FUSED PHYSICAL SCIENCE COURSES IN HIGH SCHOOL

State	Cities in Group		Replies Received		Offer Courses	
	Number	Per cent	Number	Per cent	Number	Per cent of Replies
Alabama	3	.8	3	100.0	1	33.3
Arizona	2	.6	2	100.0	1	50.0
Arkansas	3	.8	3	100.0	0	00.0
California	15	4.2	15	100.0	7	46.7
Colorado	3	.8	1	33.3	0	00.0
Connecticut	7	1.9	5	71.5	2	40.0
Delaware	1	.3	1	100.0	1	100.0
District of Columbia	1	.3	1	100.0	0	00.0
Florida	7	2.0	3	43.0	1	33.0
Georgia	4	1.1	3	75.0	0	00.0
Idaho	0	0.0	0	00.0	0	00.0
Illinois	17	4.8	13	76.5	3	22.1
Indiana	17	4.8	13	76.5	4	30.8
Iowa	10	2.8	9	90.0	1	11.1
Kansas	4	1.1	3	75.0	0	00.0
Kentucky	6	1.7	4	66.6	0	00.0
Louisiana	4	1.1	3	75.0	0	00.0
Maine	3	.8	2	66.6	0	00.0
Maryland	3	.8	1	33.3	1	100.0
Massachusetts	30	8.4	19	62.5	3	15.8
Michigan	17	4.8	12	70.7	4	33.3
Minnesota	3	.8	1	33.3	0	00.0
Mississippi	2	.6	2	100.0	0	00.0
Missouri	6	1.7	5	83.3	2	40.0
Montana	2	.6	2	100.0	1	50.0
Nebraska	2	.6	1	50.0	0	00.0
Nevada	0	00.0	0	00.0	0	00.0
New Hampshire	3	.8	3	100.0	1	33.3
New Jersey	24	6.7	16	66.6	3	18.8
New Mexico	0	00.0	0	00.0	0	00.0
New York	28	7.8	19	68.0	2	10.5
North Carolina	8	2.2	7	87.5	1	14.3
North Dakota	1	.3	1	100.0	0	00.0
Ohio	26	7.3	16	61.6	2	12.5
Oklahoma	4	1.1	0	00.0	0	00.0
Oregon	2	.6	1	50.0	1	100.0
Pennsylvania	25	7.0	17	68.0	5	29.4
Rhode Island	6	1.7	4	66.6	1	25.0
South Carolina	4	1.1	2	50.0	0	00.0
South Dakota	1	.3	1	100.0	0	00.0
Tennessee	5	1.4	4	80.0	1	25.0
Texas	15	4.2	12	80.0	2	16.6
Utah	2	.6	2	100.0	0	00.0
Vermont	0	00.0	0	00.0	0	00.0
Virginia	7	1.9	6	85.7	1	16.6
Washington	5	1.4	4	80.0	1	25.0
West Virginia	5	1.4	2	40.0	0	00.0
Wisconsin	14	3.9	6	42.9	1	16.6
Wyoming	0	00.0	0	00.0	0	00.0
Total	357	100.0	250	70.0	54	21.6

state or a higher ratio than was found for just the larger cities in the country as a whole. From the total number of courses in California, some estimate may be made as to the total high school courses in the country as a whole. For California, 46.7 per cent of the cities of over 25,000 population offered courses while 28.5 per cent of all of the high schools of the state did likewise. If the assumption is made that the ratio between courses in large cities and total courses would be approximately the same for all of the United States as for California, the proportion 46.7: 28.5=21.6: x yields x=13.1 per cent. Assuming 25,000 for the number of public high schools in the country, there would be about 3,275 schools that offer a fused physical science course above the ninth grade. This is likely an optimum value and somewhat above the true figure.

GROWTH OF SURVEY COURSES IN PHYSICAL SCIENCE

Questionnaire returns from 231 schools yielded data as to the date when the physical science course was introduced. Table IV shows the distribution as to origin for five groups of schools. In this table the normal schools are combined with the teachers colleges and the negro colleges are distributed under the appropriate categories.

It is evident that the teacher training institutions were the first to introduce these courses and were followed shortly by some of the liberal arts colleges. Very little attention was given to such courses in high schools or junior colleges until about five years ago, in 1933–4. While junior colleges have paralleled the high schools in growth, evidence was obtained in the study that they parallel the liberal arts colleges

TABLE IV

DISTRIBUTION OF SURVEY COURSES IN PHYSICAL SCIENCE BY YEAR OF ORIGIN FOR VARIOUS TYPES OF EDUCATIONAL INSTITUTIONS

	Liberal Arts		Teachers Training		Junior Colleges		California High Schools		Non-California High Schools	
School Year	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
1938–9	5	8.8	6	10.9	6	28.6	23	32.8	9	33.3
1937–8	11	19.3	1	1.8	6	28.6	14	20.0	9	33.3
1936–7	5	8.8	6	10.9	1	4.8	10	14.3	2	7.4
1935–6	8	14.0	9	16.4	3	14.3	9	12.8	2	7.4
1934–5	8	14.0	7	12.7	2	9.5	3	4.3	1	3.7
1933–4	4	7.0	3	5.5	1	4.8	7	10.0	2	7.4
1932–3	9	15.8	10	18.2	1	4.8	2	2.9	0	0.0
1931–2	1	1.8	1	1.8	0	0.0	1	1.4	0	0.0
1930–1	1	1.8	2	3.6	0	0.0	0	0.0	0	0.0
1929–30	1	1.8	1	1.8	0	0.0	0	0.0	0	0.0
1928–9	2	3.5	2	3.6	0	0.0	0	0.0	0	0.0
1927–8	0	0.0	0	0.0	0	0.0	0	0.0	1	3.7
1926–7	0	0.0	2	3.6	0	0.0	0	0.0	0	0.0
1925–6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1924–5	0	0.0	1	1.8	0	0.0	0	0.0	0	0.0
1923–4	0	0.0	1	1.8	0	0.0	0	0.0	0	0.0
Not stated	2	3.5	3	5.5	1	4.8	1	1.4	1	3.7
Totals	57	100.0	55	100.0	21	100.0	70	100.0	27	100.0

quite closely as to methods and content of their courses.

If the courses which started within the past three years are totaled, the following summary is obtained.

Type of School	Courses Started in Past Three Years
Liberal Arts Colleges.....	36.9 per cent
Teacher Training Colleges.....	23.6 " "
Junior Colleges	61.0 " "
California High Schools.....	67.1 " "
Non-California High Schools..	74.0 " "

When the four-year colleges are combined they show 30.4 per cent as having started their courses within the past three years, while 70.6 per cent of the high schools had introduced the work within the same period. These figures with the summary above indicate that recent growth of such courses has been at least twice as rapid in high schools as in these colleges.

ENROLLMENTS IN SURVEY OF PHYSICAL SCIENCE

Further data from the questionnaires that pertain to enrollments are shown in Table V. In Part I is indicated the number of sections per semester in different types of schools. All types but junior colleges averaged more than two sections per semester but the range as to the number of sections was large.

Class size as shown in Part II was considerably larger on the average in the colleges than in the high schools. Due to inclusion of small colleges considerable overlapping occurred between class size on the two levels. None of the high schools listed as large classes as did some of the colleges.

The enrollments for these courses are shown in Part III of Table V. While more questionnaires were returned by California high schools than by any other group, the teacher training schools that replied showed the greatest enrollment in the physical science survey course. Their average enrollment was the highest for the college groups with 111.2 students per school. This was exceeded by the non-California high school group with 127.8 students per school. Altogether, the actual replies indicated over 13,000 students

TABLE V

DISTRIBUTION FOR FIVE GROUPS OF SCHOOLS SHOWING THE NUMBER OF SECTIONS USED, THEIR SIZE, AND THE ENROLLMENTS IN SURVEY COURSES IN PHYSICAL SCIENCE

Type of School	Liberal Arts	Teacher Training	Junior College	California High Schools	Non-California High Schools
Number studied	57	55	21	70	26
Part. I. *Number of Sections per Semester*					
Total	117	153	28	190	99
Mean	2.2	2.8	1.3	2.7	3.8
Standard Deviation	2.0	2.3	.6	3.6	3.1
Part II. *Size of Classes*					
Mean	46.3	40.0	57.8	29.0	33.8
Standard Deviation	25.9	30.3	75.3	7.0	6.2
Part III. *Enrollments*					
Total	5414	6005	1618	5508	3324
Mean	98.4	111.2	77.0	78.8	127.8
Standard Deviation	118.2	99.4	162.2	111.8	117.1
Part IV. *Estimated Enrollments*					
Factor	1.6	2.1	3.1	1.7	152.0
Corrected Estimate	7038	9338	3276	7326	128,805

enrolled in college courses and nearly 9,000 enrolled in high schools courses in fused physical science in 1938–9.

As the total number of schools in each category was known it was possible to make an estimate of the total enrollments in these survey courses in all of the colleges and high schools in the United States. Part IV of Table V shows the factors used to extrapolate the data and the estimates obtained. As it seemed likely that the colleges not replying to the questionnaire were smaller than those that did reply, additions to total enrollment were reduced fifty per cent for these schools. The same was done for the California high schools. As the non-California high schools that returned questionnaires were all located in cities of over 25,000 population and hence were large schools the increases due to extension of their data were reduced 75 per cent. After these reductions were made the estimated enrollments show nearly 20,000 students enrolled in college courses and well over 100,000 enrolled in high school courses in fused physical science in 1938–9. Tremendous growth of such courses in the high schools is indicated. For California alone, enrollments were greater than those in such courses in all of the liberal arts colleges of the country. Figures for these two groups are based on estimates from data for 68.4 and 60.3 per cent respectively of all such courses.

SUMMARY

Important findings of the part of the study reviewed were:

1. From a study of 1,239 college catalogues and the application of a correction for padding, it was found that about 28.5 per cent of the non-professional colleges of the United States offered a survey course in 1938–9 containing materials from physical science.

2. Survey courses in physical science were more than twice as common as surveys in natural science where the physical science materials were combined in the same course with biological science.

3. Very few colleges were offering their survey work through separate courses given by the various science departments.

4. Courses in physical science of a survey nature and on levels above the ninth grade were found in 28.5 per cent of all California high schools.

5. Such courses were found to be offered in at least one high school in 21.6 per cent of the cities in the United States that have over 25,000 population.

6. Development of survey courses occurred first in teachers colleges with the most recent growth occurring in high schools and junior colleges. In the latter groups well over half of all courses have been introduced within the past three years.

7. Classes in the colleges are larger on the average than is true for the high schools.

8. Of the college groups studied, the teacher training institutions showed the largest total enrollment for physical science survey.

9. For the entire country, high school enrollments probably exceed college enrollments in such survey courses by five to one.

VOCATIONAL EDUCATION CHALLENGES THE SCIENCES

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With increasing frequency we hear that the field of Vocational Education is enlarging the scope of its courses. As a science teacher, I have watched this process with some dismay. For the vocational courses are being filled with pupils, some of whom were meant for Science classes in Chemistry and Physics, but were somehow weaned away.

Why is this happening? Why are more students electing vocational courses in preference to the pure sciences? The answers to this question are of concern to every teacher of pure science.

In the first place, we as science teachers are still teaching a course that "prepares our students for college," or, recognizing lately that not all students can go to college, we have developed a course that teaches some of the fundamental concepts of science, omitting the more difficult principles. In either case, both courses are somewhat academic in nature.

In an increasingly technical world, with the demands for specialized knowledges and skills in employment becoming more acute, with the need for more specific knowledge in making intelligent purchases becoming more important, we are still teaching academic courses in science. What the pupils are demanding of our science courses, and of their education in general, is the acquisition of the abilities to live as intelligent consumers, and to be able to graduate from high school better prepared to earn a living.

A few illustrations of where our courses in science need bolstering can be drawn from the following:

We teach our Physics students the principles of a gasoline engine, we point out its inefficiencies, but what do we teach him about actually making an intelligent selection of an automobile? What do we teach him about maintaining an automobile in good repair?

We teach our Chemistry students the principles of a mechanical refrigerator, we study the properties of the gases used in them, but again, we stop there. We don't give him sufficient information to enable him either to make an intelligent selection, nor to operate it most efficiently.

What brands of food, drugs, and sundries are the best buys for his money? What pitfalls must he look for in such commodities to safeguard his investment? Instead of teaching these vital concepts, we often stop with the fact that foods may be classified as carbohydrates, fats, proteins, minerals, and vitamins. These facts are interesting and useful, but fall short of being as practical as they might be for the average high school student.

What in our curriculum tells us how to intelligently purchase a home? We know there are different kinds of trees, our courses in Biology teach us that. But what kinds of lumber are best for the various parts of the house? How long should lumber be aged before being used? Is No. 2 yellow pine good enough for cross members of the frame, or should we insist on a better quality? We study insulators in both Chemistry and Physics, but how can we intelligently choose the brand with which to insulate our home? How should we heat our home? By coal, oil, gas, or electricity? Shall we select natural gravity or forced convection for our furnace? How can we save money by proper stoking, if we use coal? Shall we cook with gas, or electricity? Which is really cheaper? These and a hundred other questions confront the person who must make a home, yet little information of this kind is supplied

by our science courses, when so much could be offered.

What, then, is causing prospective Chemistry students to enroll in vocational courses? The answer to this question might be discovered by a visit to such a class. For instance, in a course in "Machine Shop," in addition to learning how the machines work, and how to set them, the boys actually operate them. Their knowledge is not merely vicarious, but actual. They learn not by memory or explanation, but by doing. Furthermore, the type of information is so practical that if bolstered by more training and experience along this line, it will produce a possible means of livelihood. To the boy who can't afford to go to college this means much. It means the difference between almost hopeless competition for a job requiring only unskilled labor, and a more limited competition for a better paying job, utilizing the information and experience obtained in school.

Vocational courses are practical. The economic situation today is such that our courses must be practical for the masses, and not merely academic. Unless we recognize this important fact we will find our courses giving way to vocational courses. Chemistry and Physics classes may even lose their identity as such, and only enough theoretical Chemistry and Physics will be taught in conjunction with a vocational course as will be considered helpful to meet the needs of the average skilled factory worker.

Unless our courses in Science fill the needs of men and women who must obtain jobs in a technological environment, they will not endure. Education must pay. And we are not going to be the ones who will determine whether it does pay. Mr. and Mrs. Taxpayer will continue to support us only so long as they feel they are getting their money's worth. Unless they are satisfied, we will witness increasing difficulty in getting our budgetary requirements approved.

Our courses must be levelled at the student who needs to find employment. They must meet his needs first. The special course in Science must be for the college preparatory students, and the regular course for the majority. The present policy seems to be just the reverse of the needs, and the sensible thing to do appears to be to make our course comply with the present conditions. We, as science teachers, must learn a lesson from the vocational teachers if we are to resist their challenge. We must learn to better interpret the needs of our students. We must make our courses more practical and more thorough. Only then will Chemistry and Physics continue to occupy its rightful place in an educational system which makes as its objective the satisfaction of individual and community needs.

INTERESTS OF NINTH GRADE STUDENTS IN GENERAL SCIENCE *

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PROBLEM

To attempt to find out how closely the various units of study developed in a certain science course are built around the interests of the children has given rise to the development of a functional inventory to obtain (a) a measure of students' interests in General Science and (b) a measure of interest changes within a definite period of time.

The desired outcomes of the inventory study are the following:

(1) To provide the science teacher with a direct method of making appraisals of classroom procedures in the ninth grade;

(2) To supply objective data which will lend itself to statistical treatment in order to establish its reliability;

(3) To supply objective data indicative of the relative emphasis to be placed upon the various units of study;

(4) To supply objective data showing which of the major objectives in science teaching (acquisition of skills, related knowledge, and social understanding) is receiving greater emphasis.

EXPERIMENTAL SITUATION

The parallel-group technique was used in this study as an attempt to eliminate the difficulty which invariably arises in connection with the one-group technique, the changes which take place in group or teacher with the passage of time and with maturation. In this method, two groups as nearly alike in all respects as possible are used at the same time. The two groups selected for the study consisted of (1) students who had completed the course of study in June, 1938 and (2) students registered for the course in September, 1938.

* From a Study Submitted for the Degree of Master of Education, The University of Buffalo, School of Education, June, 1939.

ANALYSIS OF DATA

The tabular arrangement of the statistical data derived from the scoring of the inventory falls into two distinct divisions. Tables 1–3 constitute the summation of the interest measurement and interest changes, while tables 4–6 indicate emphasis upon the three major objectives of science teaching. Therefore, in order to show existing relationships in interpretation, results of the first group of tabulations are presented in close association with the finding of the latter groups.

Table 1 exhibits a collection of the raw scores obtained by the two study groups, 1938–9 and 1937–8, on the first and second endorsements of each unit of the inventory as well as the scores of total interests of these two groups and the interests thought to have been obtained in the ninth grade by the 1937–8 group.

The Units

I. Food Supply and Energy of Fuels
II. Physical Condition and Disease
III. Our Clothing
IV. Water Supply
V. Heat and Its Control
VI. The Earth and Its Surface
VII. Weather and Climate
VIII. Transportation
IX. Simple and Complex Machines
X. Building Construction
XI. Communication
XII. Electricity and Light Energy

An analysis of the data included in this table shows: (1) positive scores in all units with the exception of negative interest or aversion obtained in the opinion of the 1937–8 group in the ninth grade in Unit I, "Food Supply and Energy of Fuels." * In this connection this same

* The numerical scoring of the five interest rankings from 1 to 5 respectively was: —2, —1, 0, +1 and +2.

group found their greatest interest (Table 4) in items of skills. These same endorsements when subdivided according to sex interests (Tables 5 and 6 respectively) indicate that boys' interests are divided between items of skills and social under-

Copy of the inventory directions used in the study and first page of inventory

Name..... Grade.....

INSTRUCTIONS TO STUDENTS

Guidance experts agree that when the efforts of young people are directed along the lines of their interests, abilities and needs, the result is the production of more happy, wholesome personalities, a prime requisite to a successful social order. You may be of considerable assistance to your adviser by indicating your degree of like or dislike for the following experiences which thus far you may or may not have had.

Draw a circle around one number opposite each of the following questions, which will show us how well you like to do certain things. A circle around 1 means that you thoroughly dislike it. A circle around number 3 means that you are uncertain, that if you had had more experience along that particular line you could tell better whether you liked or disliked it. A circle around number 5 means that you have had experience in and very much like it. Number 2 indicates that you believe but are not quite certain that you dislike certain things and number 4 will show us that with the experience you have had, you think your tendency is toward like.

Also opposite each question you will find the symbols H, OA, El, 9.

H — home
OA — other agency besides home or school
El — elementary school
9 — ninth grade

Please indicate by encircling one of the symbols opposite each question where, as well as you can recall, you obtained the degree of like or dislike expressed by encircling the number above.

Remember you now have two things to do opposite each question; encircle one number and one symbol. As you proceed in marking the questions, if you find that you do not remember the meanings of the symbols, be sure to turn back to this page.

Name.....

Do you like—

			−2	−1	0	+1	+2
S	1.	To care for plants and trees and dig in the garden?	1 H	2 El.	3	4 9	5 OA
	2.	To test foods for bacterial content?	1 H	2 El.	3	4 9	5 OA
	3.	To follow instructions in experiments in general science?	1 H	2 El.	3	4 9	5 OA
						Sub.	Tot.
RK	4.	To test foods for various nutrients such as starch, protein, carbohydrates, etc?	1 H	2 El.	3	4 9	5 OA
	5.	To study food values and plan a balanced diet?	1 H	2 El.	3	4 9	5 OA
	6.	To plant different things in different kinds of soil to see how they grow and make soil tests?	1 H	2 El.	3	4 9	5 OA
						Sub.	Tot.
SU	7.	To explain the meaning of big scientific terms such as photosynthesis or osmosis to someone whom you would like to have respect your ability?	1 H	2 El.	3	4 9	5 OA
	8.	*To perform experiments before others which do not involve speaking such as demonstrations with dry ice?	1 H	2 El.	3	4 9	5 OA
	9.	*To discard ideas which you believed to be correct and accept new ones in the light of scientific knowledge?	1 H	2 El.	3	4 9	5 OA
						Sub.	Tot.

standing while the girls' interests lie in the related knowledge group. Although the various items of the three classifications are indicative of activities of common experience of the two sexes as digging, planting, experimenting, studying foods, apparently these phenomena are too commonplace to engage sufficient interest. It may be possible that if these activities are to be accorded a place in the subject matter area, they may have to be related to such emotions as the strange, unusual or wonderful are able to call forth. Again it may be the failure of these activities to point toward sufficient progress that produced the expression of antipathy toward this unit of study. (2) The highest group scores obtained in any of the units (Table 1) is found in Unit IX, "Simple and Complex Machines." This subject matter appeal may be explicable in that modern activity, progress and development attain their highest expression in the gamut of subject fields in aeroplanes, boats, motors and the like. Here in pupil operation, construction, assemblage and collection, both sexes find an outlet for expression. Development consistent with the growth appreciation of pre-adolescent, adolescent or adult is manifest in toy, model or man-sized machine. Referring to Tables 4, 5 and 6 in this connection, it is noticeable that group emphasis is upon items of skills while the division according to sex indicates a split in the interest items of both boys and girls between skills and social understanding. (3) Least interest is found in Unit X, "Building and Construction." Building arches, trusses, planning rooms and selecting building materials, appear to be too far out of the realm of present experience and are evidently not acceptable from the point of view of storing information for future reference. If any interest can be claimed for this unit, it may be said to be centered in items of social understanding for the group (Table 4), skills for the boys (Table 5) and a division for girls (Table 6) between related knowledge and social understanding.

Combining analyses of Tables 2 and 4, the data show: (1) girls of 1938–9 group (group which had not had instruction in General Science prior to filing in the inven-

TABLE 1

COMPARISON OF SCORES BY UNITS OBTAINED BY THE 1937–8 AND 1938–9 GROUPS ON FIRST AND SECOND ENDORSEMENTS OF THE INTEREST INVENTORY AND THE INTEREST SCORES OF THE 1937–8 GROUP DEVELOPED DURING THE NINTH GRADE, FIRST AND SECOND ENDORSEMENT

Unit	Total Int. Scores 1937–8		Total Int. Scores 1938–9		Ninth Grade Int. Scores 1937–8	
	First	Second	First	Second	First	Second
1	9	–16	166	135	–7	–13
2	283	291	158	196	126	77
3	187	302	361	372	51	45
4	169	151	198	188	99	118
5	206	213	264	291	82	76
6	125	100	160	136	50	37
7	155	204	249	231	50	108
8	274	283	253	286	71	11
9	417	440	505	497	35	84
10	47	111	39	85	1	28
11	394	436	357	357	147	169
12	249	269	290	271	110	187

TABLE 2

COMPARISON OF TOTAL UNIT SCORES OBTAINED BY BOYS AND GIRLS OF THE 1937–8 AND 1938–9 GROUPS

Unit	Total Int. Scores 1937–8		Total Int. Scores 1938–9	
	Girls	Boys	Girls	Boys
1	24	–15	103	63
2	224	59	137	21
3	140	47	263	98
4	59	108	49	149
5	60	146	79	185
6	77	48	70	90
7	77	78	126	123
8	180	94	122	131
9	215	202	84	421
10	–26	73	–1	40
11	250	144	167	190
12	82	167	92	198

tory) indicated greatest interest in Units III, "Our Clothing"; XI, "Communication"; II, "Health and Disease"; IX, "Machines" and VII, "Weather and Climate." The interests of the girls' group (1937–8), which had had instruction in General Science when the inventory was presented, are very similar, the differences being mainly in matter of emphasis. Both groups expressed aversion to Unit X, "Building and Construction" and both groups placed most emphasis upon items pertinent to related knowledge and social understanding. (2) The interests of the boys' groups, 1938–9 and 1937–8, proved to be in Units IX, "Simple and Complex Machines"; XII, "Electricity"; XI, "Communication"; I, "Fuels and Energy of Foods,"—S. This younger group expressed no aversion toward any of the units, but showed little interest in "Health and Disease," Unit II. The 1937–8 group were averse to Unit I, "Foods and Energy of Fuels." The interests of both groups lie in items of skill and social understanding.

In order to obtain the rank of unit interest (See Table 3) the scores of Table 1 were arranged in descending order and, as in Tables 1 and 2, first and second responses are indicated. Although the reliability coefficients do not indicate very high relationships, this table shows a high degree of permanency of interest in the various units, the greater fluctuation in scores found will be shown to exist in classification of subject matter according to objectives. Unit IX, "Simple and Complex Machines," holds first place in the total interests of both groups and with boys of both groups. However it is reduced to tenth and fifth places respectively when interest developed in the ninth grade was indicated.

Building construction or application of use of machines occupies almost consistently twelfth place indicating interest in the present rather than in the future.

It appears from the study of data for second rank that experience may enter into the shift of interest from Unit III, "Our Clothing," by the 1938–9 group to Unit XI, "Communication," favored by the 1937–8 group. This same influence may account for the differences expressed in Units II and V.

The rank of Units XII, "Electricity and Light Energy," VIII, "Transportation," VII, "Weather and Climate," VI, "The Earth and Its Surface," IV, "Water Supply," and I, "Food Supply and Energy of Fuels," remain relatively permanent, showing little fluctuation in the place of favor with either group, although as might be expected greater shift is noticeable between girls and boys.

The data here given seem to indicate in the main only slight influence in personality, stimulation, methods, content, etc. gained from the study of science by the 1937–8 group.

However the analysis of specific subject matter interest indicates sufficient permanence or stability when arranged in the following descending order of favor to serve as the foundation for the selection of

TABLE 3

RANK OF UNIT INTEREST RANGING FROM TWELVE, INTENSE INTEREST, TO ONE, LITTLE INTEREST, FOR (1) TOTAL INTEREST FOR 1938–9 AND 1937–8 GROUPS; (2) INTEREST DEVELOPED IN NINTH GRADE BY 1937–8 GROUP; AND (3) TOTAL INTEREST FOR BOYS AND GIRLS, 1937–8 AND 1938–9 GROUPS

	Total Int. 1938–9		Total Int. 1937–8		Ninth Grade Int. 1937–8		Total Int. 1938–9		Total Int. 1937–8	
	1st	2nd	1st	2nd	1st	2nd	Boys	Girls	Boys	Girls
Food supply and energy of fuels	9	11	12	12	12	12	12	11	10	6
Physical condition and disease	11	8	3	4	2	6	9	2	12	3
Our clothing	2	2	7	3	7	8	11	5	8	1
Water supply	8	9	8	9	4	3	5	10	5	11
Heat and its control	5	4	6	7	5	7	3	9	4	9
The earth and its surface	10	10	10	11	9	9	10	7	9	10
Weather and climate	7	7	9	8	8	4	7	8	7	4
Transportation	6	5	4	5	6	11	6	4	6	5
Simple and complex machines	1	1	1	1	10	5	1	3	1	8
Building construction	12	12	11	10	11	10	8	12	11	12
Communication	3	3	2	2	1	2	4	1	3	2
Electricity and light energy	4	6	5	6	3	1	2	6	2	7

subject matter within a science course of study for ninth grade or for a program of study for the eighth and ninth grades:

1. Simple and Complex Machines
2. Communication
3. Our Clothing
4. Electricity and Light Energy
5. Heat and Its Control
6. Transportation
7. Weather and Climate
8. Water Supply
9. Physical Condition and Disease
10. The Earth and Its Surface
11. Food Supply and Energy of Fuels
12. Building Construction

Analysis of Tables 4, 5 and 6. Table 4 indicates that (1) both groups, 1937–8 and 1938–9, place greater emphasis upon interest in social understanding. They are in agreement upon interest in skills in Units I, VII and IX (Numbers refer to original numbers in units in questionnaire). Related knowledge in Units IV and IX; and social understanding in Units VI, X, and XII. Units in which disagreements occur are II, III, V and VII.

However it is when the interests of the

TABLE 4

COMPARATIVE EMPHASIS PLACED UPON THE THREE OBJECTIVES OF SCIENCE TEACHING, SKILLS, RELATED KNOWLEDGE AND SOCIAL UNDERSTANDING BY THE 1938–9 (A) AND 1937–8 (B) GROUPS

Objective	1		2		3		4		5		6		7		8		9		10		11		12	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Skills	x	x	x			x									x	x	x	x	x					
Related Knowledge							x	x		x			x		x						x	x		
Social Understanding				x	x		x		x		x	x		x					x	x	x		x	x

TABLE 5

COMPARATIVE EMPHASIS PLACED UPON THE THREE OBJECTIVES OF SCIENCE TEACHING, SKILLS, RELATED KNOWLEDGE AND SOCIAL UNDERSTANDING, BY THE BOYS OF THE 1938–9 (B_1) AND 1937–8 (B_2) GROUPS

Objective	1		2		3		4		5		6		7		8		9		10		11		12	
	B_1	B_2	B_1	B_2	B_1	B_2	B_1	B_2	B_1	B_2	B_1	B_2	B_1	B_2	B_1	B_2	B_1	B_2	B_1	B_2	B_1	B_2	B_1	B_2
Skills	x							x		x				x	x	x		x	x	x				
Related Knowledge							x		x														x	x
Social Understanding		x	x	x	x	x		x			x	x	x				x				x	x		

boys and girls are separated into component scores that the reason for the variation becomes apparent. Study of Tables 4 and 5 show at a glance, that, although, both place emphasis upon the social understanding objective, the boys exhibit more interest in skills and the girls in related knowledge.

(2) As to the 1938–9 group (both boys and girls) are in agreement in placement of emphasis on Units I, II, IV, V, VI and VII, while 1937–8 group are in agreement only on Units VI, VII, IX and X. Consequently disagreement lies in those units not mentioned and it is with these and with the subsequent differences between boys' and girls' emphases that the science teacher must struggle in working out the teaching techniques for a desirable course or program of study. Boys of the 1937–8 and 1938–9 groups disagree only on Units I, IV, V, VII and IX while the girls of the 1938–9 and 1937–8 groups disagree on Units II, VII, IX and X.

In order to comprehend and appreciate fully the differences pointed out above, one must consider them in the light of various influencing factors as pertain to pupil, teacher and school. Special consideration must be given to the experiences which the particular course of study to which these students have been subjected has furnished. Again, it may be a point in conclusion, that the fundamental interest differences lie in the presence or absence of such experience as may be inducive to change in interest or conducive to continuance of interest. All of which reiterates the fact that the measurement of functional outcomes is not an easy research problem. It is not an easy matter to discover what new avenues of interest and satisfaction the child is following, what growth has taken place in social attitudes and appreciations, what evolution his concepts of life and environment have undergone, and whether or not he manifests scientific attitudes and utilizes scientific knowledge in meeting his problems, however basic in science teaching is the measurement of these functional outcomes.

SUMMARY AND IMPLICATIONS

The study, developed from a psychologically established premise, aims to accomplish two things: to measure stu-

TABLE 6

COMPARATIVE EMPHASIS PLACED UPON THE THREE OBJECTIVES OF SCIENCE TEACHING, SKILLS, RELATED KNOWLEDGE AND SOCIAL UNDERSTANDING BY THE GIRLS OF THE 1938–9 (G_1) AND 1937–8 (G_2) GROUPS

Objective	1		2		3		4		5		6		7		8		9		10		11		12	
	G_1	G_2	G_1	G_2	G_1	G_2	G_1	G_2	G_1	G_2	G_1	G_2	G_1	G_2	G_1	G_2	G_1	G_2	G_1	G_2	G_1	G_2	G_1	G_2
Skills	x			x	x	x	x							x				x		x				
Related Knowledge	x	x					x	x	x	x				x	x	x	x			x	x	x		
Social Understanding			x				x				x	x	x					x	x				x	x

dents' interests in a given field (General Science), and to measure the interest changes of students within a period of one year. The study also looked forward toward four definite outcomes, through these measurements, which may be summarized as follows:

1. Statistical data seemed to offer sufficient evidence for appraisal of present classroom procedures since the data have shown that children in the ninth grade enthusiastically endorsed certain experiences, samplings in the science field, before being given any direction in the study and that this same enthusiasm waned under the direction given. Interest in one unit of study actually took on a negative turn, leaning slightly toward aversion. This area especially indicates a need for reconstruction.

2. The second desired outcome of the inventory, that of supplying objective data, which would lend itself to statistical treatment in order to establish its reliability may have resulted in a point of confusion. Distribution had to be kept in mind throughout the study between the permanence of interests estimated by the individual and the permanence of the likes and dislikes expressed in answering the inventory, since the former represents the reliability of the questionnaire as a measuring device, while the latter refers to the mental set of the individual over a longer period of time.

Repetition of the experiment at the end of a two week period established the reliability of the inventory to be .77. For control of the permanence of likes and dislikes of the individual, two groups were equated according to two objective measures, "Kuhlmann-Anderson I.Q. Tests" and "Analytical Scales of Attainment," so that whatever results were obtained by the group which had not studied General Science could be said to be indicative of the mental states as regards interests of the students who completed the course, before taking it.

3. The analysis of the data indicated sufficient permanence or stability of interests to serve as a major criterion for the selection of subject matter in a science course of study for the ninth grade or for a program of study for the eighth and ninth grades. From ascending to descending intensity of interests the units of study receive the emphasis shown on page 27.

1. Simple and Complex Machines; 2. Communication; 3. Our Clothing; 4. Electricity and Light Energy; 5. Heat and Its Control; 6. Transportation; 7. Weather and Climate; 8. Water Supply; 9. Physical Condition and Disease; 10. The Earth and Its Surface; 11. Food Supply and Energy of Fuels; 12. Building Construction.

4. The fourth point in the purpose of study, to which an answer was desired was the determination of the relative emphasis being placed upon the major objectives of science teaching when they were thought of as pertaining to skills, related knowledge or social understanding. Groups stressed social understanding and placed slightly less emphasis upon acquiring skills than related knowledge. In independent studies, however, of boys and girls, although both sexes gave importance to social understanding, boys preferred emphasizing skills while girls were more interested in the related knowledge objective.

A STUDY IN TEACHING SCIENTIFIC METHOD AND ATTITUDE IN THE JUNIOR HIGH SCHOOL

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The schools have accepted the responsibility of educating students toward consumer literacy. Classroom science is now concerned with accenting a method of thought rather than the accumulation of many unrelated and non-essential facts.

In what years of the school life should this education begin? Should the science department alone be responsible for its development? How will this program affect the present study-content?

We have here the basis for a study of several important questions: first, whether it is possible to inculcate the scientific attitude toward everyday things as a part of the curriculum; second, whether it is possible to develop a scientific method, at least in the purchasing of well-advertised products, on which consumer research investigations are made; third, to study the value and effect of modern advertising on the junior high school pupil; and finally, to develop a project immediately related to the present curriculum and also related to life outside the school.

The shops in all schools are really laboratories in which many boys have their initial contacts with modern materials and methods of construction. They have, also, the opportunity to test these materials and methods through actual fabrication and use. The general shop subjects could well become "Industrial Science."

For this study I selected three shop classes of eighth-grade boys, who had had one and a half years of shop and general science. The groups numbered 9, 11 and 17. The average age was 13 years, 6 months.

The automobile storage battery was well adapted for the study investigation, as it is a practical necessity, extensively advertised, and one with which the boys were unfamiliar. It was desirable to obviate, as much as possible, strong, preconceived notions or prejudices. I was influenced by my own lack of knowledge as to comparative values, as well as by the boys' lack of knowledge of the operation of a storage battery. The various battery companies advertise in good periodicals, and recent developments in the industry have given rise to new claims and new guarantees.

The boys spend only two single periods a week in the shop; thus the development of the project took several weeks. One quarter of each period was spent in discussion or experiment (in all about two hours with each group), but many interviews took place outside. Merchants, service men, and battery companies cooperated. The library was a valuable aid and the technical manuals released by the companies were a source of material that was especially helpful in teaching the operation of the storage battery. No unusual emphasis was placed on the project. It was simply part of the day's work.

INTRODUCTION TO PROJECT

The general discussion of values and things that make for wise buying started with a new automobile as the focal point, and although it was agreed that the same ideas would doubtless apply to other things, the automobile was kept in mind.

Although the discussions varied, the same conclusions were reached by each class, almost in the same words, with the exception of the last, which was well supported by the boy who advanced it.

The conclusions are summarized below. Quotations are the expressions of the boys:

A. "Read advertisements carefully."
"Don't believe everything you read."
"Advertisements in good magazines count for more than the ones found in cheap magazines."
"Some advertisements are misleading." (General statements can give the wrong impression.)

B. "Talk to people who know."
"Don't pay too much attention to the man who is trying to sell you a car."
"Ask several people and compare what they say."
"Ask the man who owns one." ("But sometimes he's prejudiced.")

C. "Read up on it."
(The idea was advanced by the instructor that the purchaser might know little about cars. The idea of the technical manuals put out by the different companies was immediately offered, as an opportunity to learn and compare.)

D. "Test several cars."
"Consider the price. Compare only cars in the class you can afford."
"If the choice narrows down to two cars, try them out again, in a different way, as on rough roads."
(The idea of experimentation was, of course, strong in this instance.)

E. "Make up your mind."

F. "Use your own judgment."
(This idea was, perhaps, not too well expressed, but the boy explained that his meaning was that when you were sure you had picked the right car, after careful thought and study, not to be concerned with the ideas or opinions of others.)

Note 1.—It was unnecessary to lead this discussion. The boys agreed that any opinions sought should be expert and unbiased, and they seemed to have established quite a definite relationship in the sequence of the steps to be followed.

It seemed to correlate so closely with established scientific method that nothing was added to the items given above. These main headings, by the way, were left on the blackboard throughout the entire experiment.

This seems to be the correlation:

1. Defining the problem.—Selecting a new car, in your own price class.
2. Study the facts—analyze the data.—Read advertisements and technical manuals.
3. Turn to expert opinion.—Ask the man who owns one. Get impartial opinions from mechanics.
4. Experiment.—Test the cars.
5. Verify.—Re-test possible choices under different conditions.
6. Judge.—Make up your own mind, unswayed by others.

PROCEDURE I

Advertisements by eight of the leading battery companies were cut from the *Saturday Evening Post* and *Colliers*. They were placed on a large bulletin board turned away from the class.

Continuing the thought of the previous lesson concerning cars, the instructor started a discussion concerning the things on a car that everyone should know how to maintain in working condition, if the car is to run. These were decided to be:

A. Gasoline.
B. Lubrication—Changing oil.
C. Care of tires.
D. Water for the radiator — Anti-freeze in the winter.
E. The battery.

The motor and all mechanical devices were eliminated, the boys deciding that facts concerning these things could not be known to most women who operate cars.

It having been decided that the battery is one of the important essentials of the car, the question was asked, "If the battery in your car wore out, what battery would you buy?"

The replies were governed by the make of battery in the family car, when it was known, or by the familiar names of Willard, Exide, or Delco.

The bulletin board was turned around and the boys asked to go to the board and read the advertisements carefully. Each was to select a battery and write a paragraph telling why he selected it.

Attention was called to the headings on the board, and it was suggested that the boys "Talk to someone who knows" or "Ask the man who owns one" before the next meeting of the class.

As the period closed the instructor asked, "Just what are you going to ask about batteries?"

Price and how satisfactory they had been for others seemed to be the main objectives. It was decided that it might be a good

idea to find out how storage batteries worked before going on, too far, with outside investigation.

In one of the groups this final procedure was not carried out and the investigation went on at home. In this group, the prejudice in favor of the battery used by the family was difficult to overcome, and with this group the experiment lacked the force noted in the others.

In the largest group, Procedures I and II were partially reversed, the experiments coming before the advertisements. In this group the success was greatest.

Each of the typical responses of the pupils was hastily written to express an opinion. No effort was made to impress the boys that it was unusual or important. It was simply to be used as a basis for future discussion.

The responses given herewith are chosen for their exemplification of the different reactions to the advertisements. The responses are as written by pupils and not corrected for English usage.

Pupil A. If I were buying an auto battery for general use I would buy an Auto-Lite—because the company which makes them has been in business for several years and makes good auto ignition equipment of all kinds. Auto-Lite batteries have fiber glass separators which no other company advertises. Wood will rot away after a few years hard service. They advertise oversize plates but so do all other companies. I have used other Auto-Lite model "T" coils and they work well. They are not new-fangled, cheap junk like so much modern equipment but of original design and high quality.

Pupil B. I think the new Willard "H-R" is about the best. One advertiser states that their battery lasts 100% longer. But—100% longer than what? The Willard lasts 68% longer than 100 other kinds of batteries which have been tested. It is also supposed to give just as much power. Other batteries have good qualities like this also. A few makes evidently had nothing especially good about them, because the advertisements only stated that the batteries were good batteries and not good in any special way.

Pupil C. I chose the Goodrich battery because it is guaranteed to last as long as your car. It is a super power battery and has a special top cover that keeps all the power sealed in. You also can sell your old battery and get a trade-in allowance. If anything happens to the battery the company will give you a new one without charge. There are heavy plates on this battery that store more power and it is used in submarines, planes, and trains.

Pupil D. From looking at the board, I would say that an Exide would be a good battery to buy. If it is, as they say, true that Exide batteries are used by police cars, elevators, and other large appliances, the batteries must be quite reliable. Another well-known battery is a Willard. If a Willard battery has as much power as is said in the advertisements they must pack enough power to give anyone good service. They are also packed in quite a durable case.

Pupil E. I think, by the advertisements on the bulletin board, that I would like the Willard battery.

Why, because it was a good advertisement, had plenty to say about the battery that was good. The battery looked like a strong powerful battery which is necessary to have in the car today. The battery was also powerful enough to give all the small implements in the car, that need a battery to run them with, plenty of zip. When the starter is pushed there is plenty of power which starts the motor right away. Forty-two thousand Willard dealers back it up.

Pupil F. The battery I choose, and think is the most effective is Exide. Our family uses this battery as many others, numerous others, and famous shops also use this storage battery. The New York police force which depends upon their radio and quick starting use it. The Willard and Exide are probably the best known and most widely used. It is contained in an economical case which keeps it from all the wear and tear of the engine. Also the fiber case withstands much wear. It also has moderate price.

PROCEDURE II

The experiment material employed is here briefly described.*

1. An old, worn-out battery was secured. This battery was cut up by members of the class so that all parts of the case could be seen and the elements removed. The materials were then removed from the positive and negative plates so that the plate construction could be seen. The composition of the materials for each plate was simply explained. The separators were examined and their use

* All three classes had a basic understanding of simple electricity: the chemical action of a dry cell, the complete circuit, voltage, and direct current.

explained. The condition of the wooden separators was noted.

2. A simple storage battery was constructed, using a laboratory battery-set, a tungar charger, two strips of lead, solution of sulphuric acid, voltmeter, and a door-bell to be rung by the charged battery. A strip of wood was used as a separator (for effect) and the importance of the separator stressed. A hydrometer was used for a demonstration, and a simple explanation of specific gravity was given.

   The cell was charged, timed; the bell rung for discharge, timed. The loss of voltage was noted. The condition of the plates after the experiment was studied. (The lead strips had been carefully cleaned before the experiment.) The color of the material formed was compared with the positive plate material of the battery that had been torn apart. The result of a short circuit between plates was shown.

3. An old battery that would take a charge but hold it only for a short time was secured from a local battery dealer. The specific gravity and voltage were noted and the battery was placed "on charge" over night. It was tested again the next day.

PROCEDURE III

The Society of Automobile Engineers was discussed. The function of the S.A.E. was explained, and the classes agreed that the findings of this Society should be accepted as expert opinion.

Capacity ratings of the S.A.E. were explained and the mathematics of ampere-hours at the three capacity ratings worked out from the Delco handbook. The importance of temperature in relation to batteries was studied.

Cheap batteries were discussed. The lack of S.A.E. markings on the cases was noted. The price was checked in the relation to the amount that could be obtained for a worn-out battery, on a trade-in basis.

A brief discussion disclosed that the boys knew of the different organizations doing research investigations for consumers. It was agreed that they, also, would be accepted as expert opinion.

Committees volunteered for outside investigation.

Note 3.—It was agreed that committee investigations should be based on battery types of the same SAE rating, as to price and quality. This information was to be obtained from service stations, garages and factories, or main offices; and as to service, from people who had had experience with the type under question.

One committee was to look up any bulletins or reports on batteries by research organizations, available in the school library.

PROCEDURE IV

Committees reported. (Except the Library Committee.)

Technical manuals secured by the committees were examined.

Model Exide and Goodrich batteries were brought in by their respective committees. These batteries had sides cut away to show major features of construction, and these differences were explained.

Note 4.—The boys borrowed the model batteries from local dealers. Letters were written to main offices for technical manuals. advertising material and separator samples.

PROCEDURE V

The function of the generator of a car was discussed.

And old generator was examined.

The battery installation in the instructor's car was observed, to explain why batteries have different shapes, where they are installed, and why they sometimes fail to give good service.

A resume was made of the demands of the modern car and its appliances on the battery, with relation to its capacity.

Note 5.—Procedures IV and V were carried out almost simultaneously, rather than have the numerous committee reports lose their interest.

There is a small automotive shop in connection with the industrial arts department. The car was driven in during classes and in the regular period, as part of their shop-work, some of the boys tested the battery; cleaned and vaselined the

terminal connections; added distilled water, and examined the cables for wear and breaks.

PROCEDURE VI

The battery advertisements on the bulletin board (which had not been in evidence since Procedure II) were again produced and discussed.

Misleading generalizations were sought.

The importance of the new separator materials was discussed. The relation of the use of these new materials to price and the guaranty was brought out.

The differences in guarantees were explained.

PROCEDURE VII

The boys were asked to vote on which of the batteries they would buy, giving their reasons. The summary of the votes of the three classes is given in Table I. The reasons given were: reputation of the company; new construction features; life of the car guarantee; personal or family experiences; advertising.

TABLE I

FIRST VOTE OF THREE CLASSES

	Class A	Class B	Class C	Total
Battery "A"	6	4	7	17
Battery "B"	6	2	2	10
Battery "C"	1	0	1	2
Battery "D"	2	0	0	2
Battery "E"	2	1	0	3
Battery "F"	0	0	0	0
Battery "G"	0	2	1	3
Battery "H"	0	0	0	0
				37

PROCEDURE VIII

The library committee, who had been examining research files, offered a report on batteries for the current year. It was given almost verbatim from the files.

This report concerned itself greatly with Battery "A". According to the bulletin, this battery, although in the high price range, failed to live up to its ratings, was poorer than batteries that cost one-third as much, and failed to carry necessary quality ratings on the case.

PROCEDURE IX

The classes were asked if there had been any change of opinion as a result of the previous report. Their vote is given in Table II.

TABLE II

SECOND VOTE OF THE THREE CLASSES

	Class A	Class B	Class C	Total
Battery "A"	1	2	0	3
Battery "B"	11	6	6	23
Battery "C"	0	1	1	2
Battery "D"	2	0	0	2
Battery "E"	0	0	1	1
Battery "F"	0	0	0	0
Battery "G"	3	2	1	6
Battery "H"	0	0	0	0
				37

The reason for the shift from Battery "A" is obvious. The three boys who did not change had used this battery in the family car with good results for several years. The shift was to Battery "B" recommended in the report as a good buy as to quality and price; and to Battery "G", also well spoken of in the report, but a rather high priced battery, for its lifetime guarantee. It was pointed out by the defenders of Battery "A" that no mention was made in the report of the new separator materials or the lifetime guarantee, and that, therefore, the report was out of date. The committee countered with a research report three years old in which Battery "A" had received just such a poor rating.

CONCLUSION

The results of this study would seem to indicate that the average junior high school boy is apt to be impressed by the massive type of advertising. He is prone to accept misleading generalizations, but is willing and can be trained to seek out the facts. He can become a good buyer, at an early age, through educational experiences, contact with advertising mediums, personal school savings, and liberal pocket money.

Some of the boys showed unusual ability

to detect the strong points in advertising, and the entire group obtained knowledge in forming judgments. Prejudices, however, were easily formed. When the instructor used a certain type of battery for a demonstration, the class was inclined to favor that battery. The boy also relies heavily on the judgment of his father, and the father's related past experiences. This is displaced, however, with the accumulation of personal knowledge. He is impressed by genuine comparisons, when he understands the basis for the comparisons. Deferent to expert opinion, he is willing to believe.

The teaching of consumer literacy certainly has its place in modern education. With the nation spending millions on automobiles, clothing, building materials, and food; and being expected to make wise choice in the face of twentieth century methods of business competition; when false values are flaunted before our eyes from billboard, newspaper and magazine, and dinned into our ears via the radio, then the school should start early to lend a hand to the future consumer.

It is my belief that the study would have been worthless if the laboratory method had not been used. The practical work in connection with the investigation sustained interest and aided understanding.

AWAKENING NEW INTERESTS IN SCIENCE

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Over a period covering the past five years I have encountered on numerous occasions an apparent dislike for Science among Junior High School pupils. Although this feeling is not general nor widespread it does affect quite a number of the pupils enrolled in our present elementary Science classes.

Personally I believe Science is of universal importance due to its need and use by every individual. Therefore, isn't it worthwhile to attempt by whatever means possible to awaken an interest in Science and a desire to better themselves through a study of Science? After all it should never be said that Science is a dry, uninteresting subject.

In an effort to awaken a desire for Science in the minds of some of my pupils who have shown or expressed a dislike of the subject, I have introduced the reading of good books pertaining to Science. Although the library facilities are very limited in a small town, I have made out a suggestive list covering approximately one hundred books. The first readings were given as an assignment and at the time met with disfavor especially among a few of the seventh grade girls. They told me, "Science is a subject for boys and what can we find of interest to read concerning Science?" Naturally the challenge was very easily met. After helping them with the selection of books and giving some suggestions, they really have proceeded to consume the contents of many books which they would not have even looked at before.

Although the idea is old and simple, it has brought very encouraging results in my case. The only thing that worries me is getting more books as the present supply is being rapidly exhausted. Everyday I am called upon to help locate some book for an anxious reader, and most of my Junior High School pupils plan ahead in an effort to obtain a book when the present reader returns it. However in most cases it has been promised to one, two, or three classmates so they must wait their turn. Needless to say they do turn to other books

until that one is available. I also noticed that many of my pupils have gone ahead and found good books which I had omitted from my list. The list, of course, is not complete and was meant to be suggestive. They really get more out of it if they can pick their own books and have them approved.

In this article I can list only a few of the books which have seemed to be most popular in my groups. However if you will glance through the card catalog of your school library no matter how small it may be, I am sure you can build up a fine list of interesting books relating to Science which your pupils will be anxious to read. The boys naturally seem to prefer books on aviation and consume all available materials on the subject, while the girls' interests seem to be more widespread. However they do not by any means attempt to read only books relating to women in Science.

The following is a partial list of the books which have proven most popular in my particular situation:

Beebe, William, *Edge of the Jungle, The*
Beebe, William, *Exploring with Beebe*
Beebe, William, *Jungle Days*
Bryan, G. S., *Edison, the Man and His Work*
Buckingham, B. R., *The Attack and Other Stories*
Buckingham, B. R., *Too Many Bears and Other Stories*
Burroughs, John, *Squirrels and Other Fur Bearers*
Collins, A. F., *Boy's Book of Submarines, The*
Cotter, Joseph, and Jaffe, Hayme, *Heroes of Science*
Crump, Irving, *Boy's Book of Airmen, The*
DeKruif, Paul, *Men Against Death*
DeKruif, Paul, *Microbe Hunters*
Fabre, J. H., *Insect Adventures*
Garland, Hamlin, *Boy Life on the Prairie*
Gravatt, Lila, *Pioneers of the Air*
Humphreys and Hosey, *Romance of the Airmen*
Keller, Helen, *Story of My Life, The*
Kutchin, Victor, *What Birds Have Done with Me*
Mills, E. A., *Story of the Thousand Year Pine and Other Tales of Wild Life, The*
Muir, John, *Boyhood of a Naturalist, The*
Pawson, K. L., *A Boy's-eye View of the Arctic*
Rolt-Wheeler, *Boy with the U. S. Naturalists, The*
Roosevelt, Theodore, *African Game Trails*
Siple, Paul, *A Boy Scout with Byrd*
Tappan, E. M., *Heroes of Progress*
Wylie, C. C., *Our Starland*

SCIENCE WRITES A PLAY *

Playing up the dramatic aspect of scientific phenomena in University High School resulted in a student written and produced entertainment for the community. It all started in the chemistry laboratory where the science teacher introduced the spectacular chlorine family by releasing the gas into the air in a demonstration. As it diffused such questions as these were raised: What is this gas? Where did it originate? What are its uses? To answer them, extensive reading and investigations were carried on. Student committees interviewed the druggists, flour mills operators, grocers, managers of laundries, city water works and hospitals to learn how chlorine compounds are used.

Our educational philosophy for the past three years has been based on the premise that education means more than the mere accumulation of facts and skills; that a child is not a bundle of separate capacities and traits each of which can be separately trained by appropriate drill. He is a person who initiates activities and has a right to develop into the highest type of person his capacities permit. The greatest stimulus to growth comes through living with others, contributing to the general good, developing powers, and achieving personal recognition and success. A child is being truly educated when his behavior is chang-

* The evaluation of the original writings of the students was made by A. M. Poole, Critic Teacher in Science, and Nell Doherty, Critic Teacher in English.

ing in such ways as to make him a continuously happier and a more useful member of society.

The pupils have developed an alertness to the opportunities inherent in school experiences for further interesting, unusual and worthwhile activities. Naturally, then, the dramatic demonstrations of the qualities of chlorine, the extensive reading done on the subject and the fruitful interviews with the townspeople aroused so much interest that plans for a play writing project took form. The class felt that more efficient work could be done on the writing of a play by a smaller group. A committee was appointed who collected from the class a detailed list of the scientific facts to be used in a play. These were organized under headings for possible scenes, such as a hospital, at home, in the war, in city life. In informed discussion they outlined a plot with the necessary settings and characters and submitted it to their English teacher who discussed with them the elements necessary for good drama—human interest, suspense, trueness to life, excitement, variety, proportion, consistency of characters and logical arrangement of scenes. After deciding what ideas could best be depicted by conversation and which by action they worked by themselves developing the dialogue and stage business. Again it became an English problem to evaluate the clearness of dialogue and the naturalness of expressions. Weaknesses most apparent were those of meager conversation and inconsistent characterization. The committee suggested interviewing the social science teacher to enrich the expression of social purpose and action, the National Guard for information as to gas attack in the war, the nurses to settle points of professional ethics. A more lively and sincere dialogue resulted from these conferences. The form of the written copy was determined after studying other plays. Revision proceeded slowly, but finally the manuscript was submitted to the science instructor and the class and received their approval.

The authors, being unable to decide on a satisfactory title worked out a plan for a city wide contest. They summarized the play for the students in the city schools, collected suggested titles, presented them to a board of judges and awarded tickets for the performance of the play to the author of the best title.

Plans for its presentation now went forward. Students from the science class who could best fit the parts were chosen by the authors. They typed their copies, learned lines and rehearsed until they were ready for the English teacher's help in refining the technics of staging: attention to exists, entrances, stage balance, suggestive settings, properties, business, and expressions ad lib. These expressions and other suggestions were carefully written into the script by the authors who thus prepared a final copy for publication.

Student directors appointed a curtain raiser and stage and property managers. A day before the final production the cast gave a dress rehearsal, testing lighting, costumes and make-up. With so much careful preparation by the students themselves it is almost unnecessary to say that the actors, although amateurs, were confident and efficient in the final performance.

During the process of writing this play, two other members of the science class felt the creative urge and handed in to the instructor a six stanza poem about the halogen quartette, a term suggested by the author of their text. The ideas were scientifically correct so that without any revision of content it was turned over to the English teacher who worked with the authors on principles of verse-making, such as rhythm, rhyme and effectiveness. When the committee came to rehearse, the critics noticed that they had put the words to music and improvised dance steps to accompany it. So poorly was this done that pressure was brought to bear on them to consult experts

before being allowed to present it publicly. They consulted a music teacher for more appropriate music to accompany the poem and a dancing teacher for assistance in adapting and executing dance steps, with satisfactory results. In their enthusiasm to present a real song and dance number in peppy 1938 style, they selected materials the color of the chemicals, out of which they made themselves ballet dresses. The effect was pleasing, lending color and variety to the evening's performance.

Evaluating the outcomes of this experience, one sees not only a gain in clearer knowledge of scientific facts but individual and group enrichment in the actual situation which carried over into their daily lives.

Those who worked with the pupils in the preparation of their program and those who watched it from the audience could see changes in the behavior of the participants which showed that the experience was an educative one. A boy whose behavior in most situations is clownish and thoughtless came to practice regularly, refrained from disturbing others and performed his part with a complete sense of responsibility. The guard uniforms for the war scene were secured by the student who, for the first time, felt true satisfaction in helping with a school activity. A girl who is very shy and retiring in the classroom was convincing and confident as the mother in the play. The radio announcer had the courage to express spontaneously from the stage his feeling of appreciation for the help of the faculty advisors.

Strong group feeling was shown by everyone who took part. The authors chose the cast, not on the basis of friendship, but on the basis of fitness for the part. The schedule of practices was planned cooperatively, and vigorously observed by everyone. In the process of rehearsing new ideas for change of dialogue, settings or properties were taken frankly and courteously to the authors for their approval. Everyone recognized the authority of those who had been given special responsibilities and had no wish to go over their heads. When the war gases threatened to overpower the audience, everyone tried to help correct the misjudgment of one individual.

Some of the development which appeared in the work on this program have carried over into other activities. In the science class more interest is now shown by all students, particularly the participants. There is a more general desire to "play-around" with experiments. One chronically tardy boy appears in the chemistry laboratory promptly on time since his participation in the play. A very capable boy who played the hero's part, previously felt himself inferior to the other students and was friendly only with his more immature schoolmates. The prestige he acquired through the play enables him to be more informal and confident, helps him to make friends with pupils who are his equals, gives him a desire to participate in more activities. Instead of speaking Spanish whenever possible as previously, another member of the cast has come to take pride in using and refining his English. Even a boy who left the school two years ago because he did not appreciate its educational program showed enough interest to contribute the winning title and to attend the performance. One of the halogen quartette is now so much interested in creative writing that she is making an intensive study of its possibilities as a career.

For the teachers to see the development of wide interests, broad social purposes, respect for the truth, strong convictions, effective social action and high personal standards was the greatest of professional satisfaction. Two remarks made by one of the teachers best shows the professional advance made by the teachers participating in this shared experience. Last September: "English and science are as far removed as the poles"—and now: "This is the most

satisfying experience in my professional career."

A CHLORINATED ROMANCE

By LOUISE LOPEZ, DORA GONZALES, TONY COCA

Characters

Joe	Nurse
Uncle Tom	Doctor
Lorraine	Stanley
Mother	Dough Boys

(As Uncle comes in Joe is sitting in a chair with a pile of books studying. He is not aware of his uncle's presence until he says:)

Uncle: Good morning, Joe. You're studying rather hard it seems.

Joe: Yes, I am. I didn't have time last night.

Uncle: Had your breakfast? I went for a walk already. (Takes a chair.) All right, son, let's have breakfast. I suppose you and I are the only ones left. (Joe nods his head and then sits down at the table. He seems disturbed about something. Finally he says:)

Joe: Uncle, I'd like to ask you something, if you don't mind.

Uncle: No, Joe. Go right ahead.

Joe: Well, the teacher told us to find out all the uses of chlorine, and I thought you could tell me about its use in the war.

Uncle: Well, let's see. When I was in the war, one day——

(Scene shifts to battlefield. Sound effects include boys whistling to give the effect of bullets passing through the air. Drums are struck at time bullets strike. Toy machine gun is fired. Smoke screen is laid down on stage and dough boys "go over the top" in uniform and with guns.)

Uncle: So you see, Joe, how man can make a hell on earth. (Mother comes in with waffles. Uncle greets her.)

Mother: Good morning, Tom. Why, Joe, I didn't know you were up already.

Joe: I had to get up early to do my lessons.

Mother: You could have done them last night instead of going to the movies.

Joe: Oh, well, I've finished all of them except my chemistry lesson.

Uncle: Oh, say, Joe, did you know that a different form of chlorine is used to bleach the flour for these waffles? Not only that, but also as a catalytic agent for making syrup.

Joe: I didn't know, but that's sure interesting. But what's a catalytic agent, Uncle?

Uncle: Why, Joe, taking chemistry and you don't know? Well, a catalytic agent is——

Joe: (Interrupting) Wait a minute, Uncle. Let me get some paper and ink to take some notes. (Secures them and waits for uncle to dictate.)

Uncle: A catalytic agent——

Joe: How do you spell that? (Uncle spells slowly.) O.K., go on.

Uncle: A catalytic agent is a substance that assists other substances to undergo chemical change, but does not take an actual part in it. (Uncle resumes eating waffles.)

Joe: Guess I'll have some waffles now. (Starts to remove ink and spills it on table cloth.)

Joe: Oh, gosh! Now I'm in for it. Just look what I've done!

Uncle: That's too bad, Joe. Your mother's going to get after you.

Joe: Well, I guess I'll have to tell her. (Uncle leaves table, stretches, takes paper, sits in easy chair at left as Joe calls to his mother.) Mother, I spilled the ink. (Mother enters excitedly.)

Mother: Goodness, what a mess! (Clears table. Puts table cloth on chair.) Well, let it go. It might come off when I launder it.

Joe: Couldn't chlorine be used to remove the ink stain, Uncle?

Uncle: Why, yes, Javelle water, a compound of chlorine is used to remove ink stains. (To mother) What do you use?

Mother: I use clorax, and it's rather efficient, too.

Uncle: Yes, it is efficient for bleaching, but have you tried Javelle water? It's excellent. (To Joe) Say, Joe, how would you like that for an experiment? You could remove that ink stain with Javelle water, then you would have something to tell your teacher. What do you say?

Joe: Oh, boy! That'll be swell.

Uncle: All right, then. Run down to the drug store and get some Javelle water. And hurry so you won't be late for school. (He gives Joe some money, and Joe rushes out.)

Uncle: Joe takes quite an interest in chemistry.

Mother: Oh, yes. Ever since Stanley told him that he wanted to be a chemist, Joe's interest has increased. Joe is very fond of Stanley.

Uncle: And Stanley is very fond of Joe as well as Lorraine. By the way, where is Stanley now?

Mother: He's a research assistant in a chemistry laboratory in Chicago. (Joe comes in. The table has been cleared during the above conversation.)

Joe: Here it is, Uncle.

Uncle: That's fine, Joe. Now, let's see. Get me a bowl for the Javelle water.

Joe: O.K. (Does so.)

Uncle: Now I'll dip it in like this—There we are; that did it. (Displays clean cloth.)

Joe: You said it.

Mother: That's really wonderful.

(Doorbell rings. Mother answers it. Messenger boy gives her a telegram. She tears it open and reads it, becoming alarmed as she reads.)

Uncle: (Noticing her alarm) Why, what's the matter?

Mother: (Thrusting telegram into his hand) Lorraine has been taken sick at the girls' camp. (Faints.)

Uncle: Get me some water, Joe. (Uncle takes out box KBr tablets and gives her one when Joe returns with water.) (After she recovers) Are you feeling better?

Mother: Yes. Call a taxi. I must go to her.

Uncle: Come on, let's get ready. (Leads her off stage.)

Curtain

Scene IV

(As curtain rises on hospital room, Lorraine is in bed. She moves restlessly, groans. Nurse and doctor enter. Nurse takes temperature of patient and hands thermometer to doctor. He looks at it and hands it back to her then walks away. Nurse follows until they are away from bed.)

Doctor: (Worried) The patient doesn't seem to be improving. Have her parents been notified?

Nurse: Yes, doctor, they are arriving tomorrow.

Doctor: That's good. I think she will pull through. Give her a tablet of potassium bromide if she gets restless.

Nurse: All right, doctor.

Doctor: Good afternoon, nurse.

(Curtain falls as he leaves)

Scene V

Two Weeks Later

(Curtain rises on hospital scene. Joe enters Lorraine's room.)

Joe: (Peeping in the door) Hello, Sis! How are you feeling?

Lorraine: Well enough to go home, Joe. I'm surely glad I'm going day after tomorrow.

Joe: Look, I brought you a puzzle. See if you can work it, Lorraine.

Lorraine: (Looking it over) Oh, it's a chemistry puzzle. I hate chemistry. (Hands it back to him.)

Joe: Aw, shucks! Oh, I say, I almost forgot. Guess who's here to see you!

Lorraine: I don't know. Who is it?

Joe: I'm not going to tell you. You'll have to guess.

Lorraine: Oh, come on. Please tell me.

Joe: It's Stanley.

Lorraine: Stanley? When did he come?

Joe: Oh, it's been quite a while.

Lorraine: But why hadn't you told me?

Joe: Because he didn't want me to. He said——

Lorraine: How long has he been here?

Joe: Let's see, about ten days.

Lorraine: He's not through with his work, is he?

Joe: Well, he didn't say—— (knock is heard) There, I'll bet that's Stanley now! (Goes to door, greets Stanley, takes his hat, etc.)

Stanley: (To Lorraine) Hello.

Lorraine: (Indifferently) Hello.

Stanley: Hope you're feeling better.

Lorraine: I am, thank you.

Joe: (After slight pause) Well, if you're going to act like a couple of lamp posts, I'm going. So long.

(Short silence after he leaves.)

Stanley: Is your uncle coming to see you this afternoon?

Lorraine: Yes. He'll be here in a little while. Why?

Stanley: Because I'm worried. I'm anxious to know how the plan turned out.

Lorraine: Plan? What plan—what are you talking about?

Stanley: Well, didn't you know about it?

Lorraine: Know what?

Stanley: Why, I thought you knew. You see, shortly after you got sick your uncle started a movement of civic interest. He found out why you girls were taken sick. It seems the water around this community is polluted with germs and is the cause of the disease, so he spoke to all of the business people and to the different officers of the well known clubs and got them interested. Of course it took time but he got them to see that the water needed to be purified to guard the health of the community. Today, they were to meet and decide what to do about it. (During the speech Lorraine shows increasing interest.)

Lorraine: Well, I didn't know anything about it. I hope it works out all right.

(Uncle enters.)

Uncle: Hello, there, Stanley. Say, our plan worked!

Stanley: I'm sure glad to hear that!

Uncle: We sure put it across that time!

Uncle: (Walks toward Lorraine. Tilts her head with his finger under her chin, and in jolly tone says:) You're looking fine. How do you feel?

Lorraine: I'm feeling fine. And since Stanley told me about your plan I'm very anxious to know the results.

Uncle: (Surprised) My plan? You mean our plan. Why, without Stanley I don't think I could have put it across. Are you too modest to admit it, Stanley?

Stanley: Well, I—I—oh, well, it's just that Lorraine doesn't like chemistry and since the movement involved chemical analysis, I thought I wouldn't bother her about it.

Lorraine: I'm sorry, Stanley, I see I was wrong. I always thought it was a selfish thing to shut yourself up in a laboratory for your own personal gain, but now that I see it is for the benefit of society, well, it just puts the matter in

a different light. But you haven't told us what's to be done, Uncle.

Uncle: Well, they've decided to establish a filtration plant, but that takes time, so chlorine will have to be used until the plant is set up.

Lorraine: After that, will chlorine be used?

Uncle: Oh, yes, chlorine will be used afterwards, too, but not so much of it. (Looks at his watch.) Guess I'd better be going. I'll come back in the morning, Lorraine. See you later, Stanley. Goodbye. (Exits.) (Stanley starts to sit but Lorraine reaches her hand to him. He takes chair near her bed.)

Lorraine: Stanley, after this experience I've changed my attitude toward your career as a research chemist. I never thought of looking at it from your viewpoint. Somehow I didn't realize it benefited humanity. So I'd like to study chemistry, too.

Stanley: (Coming closer) You mean then that I can be your teacher?

Lorraine: Of course.

Stanley: You'll make a lovely pupil! (His arm is around her and he kisses her as the curtain falls.)

THE HALOGEN QUARTET

By PAULINE ARMIJO AND DORA GONZALES

Together

We're the Halogen quartet.
Before you take too much assumption
We will make an introduction:
Chlorine, Fluorine, Bromine, Iodine.
We're around you all the time.

Chlorine

In making dyes and extracting tin
You get the benefit of Chlorine,
When your water is purified
In that I am almost deified.
How could you get your bleaching done?
By just exposing it to the sun?
Why, that's ridiculous!
No, siree—you've got to have
The presence of me.

Fluorine

Glass bulbs that have that frosty appearance
Have had the benefit of my adherence.
And for the aluminum preparation
Cryolite enters the combination.
I really make your glass ware rare,
As when Jack Frost is everywhere.
And if on glass I do some etching,
You'll see the effect is very fetching.

Bromine

When you get hysterical
And you really get erratical
Potassium Bromide is really dandy.
You should always have it handy.
Since I'm sensitive to light
In photography I'm just right.

Iodine

Maybe there will come a time
When you'll need some iodine.
Antiseptic is my role.
I am used from pole to pole.
Now, lo! Prepare for a surprise,
I am used in making dyes!

Together

We're the halogen quartet,
With hydrogen we all combine.
In activeness we come down the line:
Fluorine, Chlorine, Bromine, Iodine.
We'll be seeing you some other time.

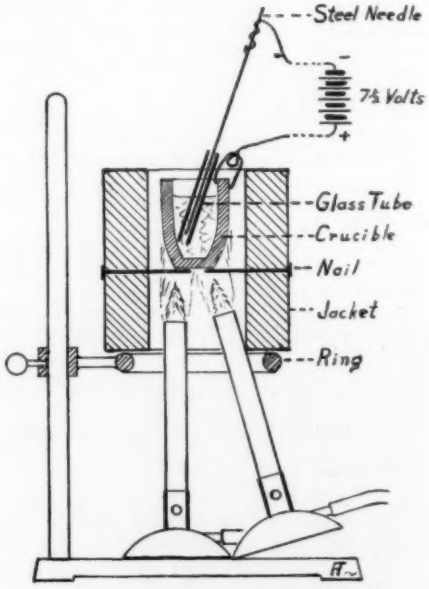
Classroom Notes

Metallic Sodium from Sodium Chloride—A Simple Experiment.—Sodium is the sixth most abundant element in the earth's crust, but because of its activity it is never found there in an uncombined state. Pure sodium is a soft metal easily cut with a knife. When it is freshly cut its brilliant silvery luster is conspicuous, but in a very short time the luster becomes dull and nonmetallic because of the oxidation of the metal. Sodium melts at 97.5 degrees Centigrade and boils at 880 degrees Centigrade. When the element was first prepared by Sir Humphrey Davy in 1807 by the electrolysis of moist sodium hydroxide, it was a laboratory curiosity. In recent times, however, the industrial uses of sodium have increased to such an extent that the annual production of sodium in this country exceeds that of gold, silver, cobalt, mercury, or magnesium.

Metallic sodium is used in the production of such compounds as tetraethyl lead, sodium peroxide, and sodium cyanide. It is used as a reducing agent in the preparation of some of the rarer metals and in certain organic syntheses. In the manufacture of many light alloys, sodium is added as a deoxidizing agent. Because it conducts electricity as well as three times its weight in pure copper, and is very much cheaper than copper, we may in the future see electric transmission cables made of sodium, sealed, of course, within pipes or tubes of some less active metal.

The first successful commercial process for the production of metallic sodium, and the only method for many years, was that of Castner, patented in 1891. In this process a current of electricity was passed through molten sodium hydroxide and the sodium was collected at the negative electrode.

It was early recognized that there was a need for some process whereby sodium might be obtained directly from sodium chloride, ordinary table salt. This abundant compound is much cheaper than sodium hydroxide. Also, when it is electrolyzed in molten state it yields chlorine gas—a substance of considerable value in various chemical processes. While, theoretically, production of sodium from fused sodium chloride is just as simple as the production of this metal from fused sodium hydroxide, there are several practical difficulties. The chief one is that the melting point of common salt (805° C.) is higher than that of sodium hydroxide (318° C.). Since sodium bursts into flame in air at a temperature of about 600° C., it is clear that it would be difficult to collect any sodium at all from an ordinary sodium chloride cell. The lighter sodium floating up through the molten chloride, would come in contact with the air and burn. Another difficulty is that fused sodium chloride will melt and corrode its way through most of the materials which might be used for the container itself.



Electrolysis of NaCl

In commercial sodium cells the first difficulty is overcome partly by adding other compounds, such as sodium carbonate, to the sodium chloride so as to lower the melting point, and partly by designing the cell so that the sodium is kept out of contact with the air. In some of the cells firebrick is used for the container. In others the crucible is made of solid sodium chloride kept from melting by cold water circulating through pipes embedded in the salt. Among the sodium chloride cells used commercially are the Acker cell (1902), the Ashcroft cell (1906), the McNitt cell (1917) and the Downs cell (1924).

It is difficult to reproduce working models of any of these cells so that metallic sodium may be prepared in the high school or college chemistry laboratory or on the chemistry lecture table. However, by using a very simple technique to keep the sodium which is formed by the electrolysis of molten salt in a small graphite crucible out of contact with air, it is possible to prepare sodium in the classroom and to study its chemical and physical properties.

The accompanying diagram illustrates the method. A graphite crucible (Dixon Graphite

Crucible # 00) is surrounded by an asbestos chimney or jacket made from a six-inch section of regular two-inch steam pipe insulation. Nails are thrust through the asbestos jacket to hold the crucible in place near the center of the chimney. Heat is furnished by two ordinary Bunsen burners. Current for the electrolysis of the molten chloride is furnished by five dry cells connected in series (7½ volts). The anode is the graphite crucible in which the salt is melted; contact between it and the battery is provided by a wire ending in a heavy galvanized-iron spring clamp which grips the rim of the crucible. The cathode consists of a steel knitting needle the lower end of which is inserted into a short length of glass tubing. The glass tube extends about a half inch below the end of the needle. The needle should be bent slightly to keep the glass tube from slipping off.

In obtaining the metallic sodium, the crucible is filled with ordinary table salt, and heated by the two burners until the salt melts. Additional salt should be added during the melting process to bring the level of molten salt near to the top of the crucible. The clip on the wire to the positive terminal of the battery is then attached to the crucible with the aid of a pair of crucible tongs. The upper end of the knitting needle is connected to the negative terminal of the battery and the lower end, covered by the glass sleeve, is warmed in a Bunsen flame so that the glass will not crack when the electrode is plunged into the molten salt. When the knitting-needle electrode is introduced into the molten material, a plug of solid salt usually forms in the lower end of the relatively cool glass sleeve. This plug melts in less than a minute and the molten salt enters the glass tube and surrounds the steel electrode. Sodium is deposited on the electrode but since a plug of frozen salt has formed between the steel needle and the upper part of the surrounding glass tube, this hot metallic sodium does not come into contact with the air. After one or two minutes the electrode is withdrawn. As this is done, a solid plug of sodium chloride forms at the lower end of the glass tube, thus sealing the metallic sodium within the tube. The electrode with its glass sleeve should not be left in the bath of molten salt for more than about three minutes, otherwise the glass may soften and slide off the steel needle.

When the electrode has cooled off, the silvery luster of the sodium may be seen inside the glass tube. Because of the salt plugs at each end of the tube, the sodium ordinarily remains fresh and unoxidized for about two weeks. If the glass tube is broken open, various simple chemical tests may be used to show that sodium is present. The small amount of this active metal will react vigorously with water to liberate hydrogen and to form sodium hydroxide. In this process the sodium often catches fire and burns with its characteristic yellow flame.

Mr. Frederick Howard aided the writer in developing this experiment for the preparation of metallic sodium from molten sodium chloride.

HERBERT J. ARNOLD
Department of Natural Sciences,
Teachers College, Columbia University.

A Bridge on Exhibition.—Since pupil activity is a feature in our educational system, the writer offers a brief description of a miniature model of the $60,000,000 George Washington Memorial Bridge constructed by a boy in our ninth-grade general science class.

Before building the balsa bridge the first step was to paint a plywood base, 26½ by 17 inches, representing the Hudson River. The second procedure was to attach an anchorage, a board, 17 inches long and 5 inches high, covered with painted canvas, to each side of the base. For floodlights, three small holes were cut out of one anchorage behind which an electric light bulb was placed.

The actual construction of the model began with the erection of the two huge suspension towers, 8 inches by 3⅛ inches by 5/8 inch. The most intricate part of the whole activity was to insert the numerous cross-beams into the frames of these tall towers. Since each small bracing strip had to be made, fitted, and glued into its proper place, considerable difficulty was encountered in doing this most careful and painstaking work. The next step in assembling was cutting and laying the floor deck, 26⅛ by 1⅛ inches. Above this roadway, the two suspension cables were fastened to the top of each tower. From these cables to the road were hung the numerous vertical suspenders made fast by strong elastic glue. When finished, the silvered bridge resembling metal and the tiny boat model were mounted firmly to the plywood.

The project, which was created during leisure time in the boy's basement, took four months to complete. Essentials used included a homemade workbench, safety razor blade, tweezers, and model-airplane cement. The entire cost of materials approximated two dollars. During a general science display in our school library, this unusual model aroused much interest among members of the student body. At the American Institute Science and Engineering Fair, New York City, the exhibit was awarded a third prize. The neat appearance and light weight make it very desirable for these exhibitions.

Success in teaching depends largely upon the knowledge of these innate urges of pupils and the skill in directing their inner powers into constructive channels. The teacher, who facilitates the realization and satisfaction of these wants, understands the adolescent needs. Therefore, if education is to function effectively, it is all important that pupils be given an opportunity to develop their practical side of life.

MAITLAND P. SIMMONS,
Irvington High School,
Irvington, N. J.

Note on an Improved Cell for Dust Counting.*—Because of difficulties arising out of loss of time in cleaning and recementing the standard Sedgwick-Rafter counting cell, a new cell has been devised eliminating cements and utilizing "Pyrex" glass in a two-component arrangement.

The cell consists of two parts, one of which is a glass plate 1 mm. thick, ground on both surfaces with a central hole of such a diameter that the cell contains approximately 0.25 ml. An optically flat polished slide of "Pyrex" glass completes the arrangement. Any suitable 35 by 50 mm. cover glass may be used with the cell, or a second "Pyrex" slide can be employed as the cover glass.

In cleaning, the parts are immersed in chromic-sulfuric acid or a comparable cleaning solution. The chemical durability of the glass makes it possible to store the cell in such a cleaning compound without impairing the optical qualities of the parts.

In preparing the cell for use, the polished slide is removed from the cleaning solution, rinsed in hot tap water, and dried carefully with a lint-free towel. The ground section containing the hole is then rinsed in hot tap water and distilled water, shaken quickly, and without drying is placed upon the polished slide. The thin film of distilled water adhering to the ground section will produce a seal to the slide. In filling, the ground section is held firmly to the slide by moderate pressure with the fingers on the edges, a quantity of the sample to be counted is introduced into the cavity formed by the slide and ground section, and the cover glass carefully slid into position to close the cell.

If the sections of the slide have been carefully cleaned and filling operations performed as described above, the quantity of sample will be sealed in the central opening without bubbles; and it will be found that it takes some force to separate the component parts.

Because of the comparatively large sealing area this cell has been found capable of retaining a water-collected impinger sample for as long as 8 hours without air leaking into the cell by liquid evaporation. In the case of alcohol samples the leaking time is considerably decreased, but may be prolonged by allowing the samples to settle in an atmosphere partially saturated with alcohol vapor.

It can readily be seen that the difficulties ordinarily arising in the cleaning of a dust counting cell are eliminated. Since the parts comprising the cell are made from "Pyrex," chemically resistant glass, any fluids other than those containing alkalies can be used in the cell without attack upon the glass.

The construction of this cell has retained the U. S. Public Health Service's standard 1 mm. depth; and measurements on the variation of depth of the cell have failed to disclose any discrepancies.

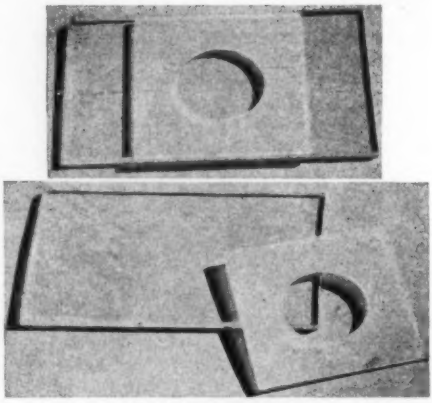


FIGURE 1. Top: Assembled for use.
Bottom: Separated for cleaning.

Although definite data have not been collected on the effect on dust counts of this cell as compared to the Sedgwick-Rafter cell, routine plant studies have been made in which this cell was used in parallel, on the same samples, with the Sedgwick-Rafter cell. No greater differences were detected than might be expected in two Sedgwick-Rafter cells.

This cell could also be easily adapted to plankton, sewage, or bacteriological studies because of simplicity of design and resistance to attack upon autoclave sterilization.

KARL L. DUNN,
Industrial Hygienist, Corning Glass Works, Corning, New York.

Microphotography.—Microphotography is by no means a new idea. However, many have been timid about attempting taking microphotographs because of the seeming difficulty involved and formidable apparatus sold for such a purpose. The following is a description of a simple method I have used.

As the diagram shows, the barrel of the microscope is turned horizontally. The camera was a Brownie, # 2 box camera (incidentally 16 years old) and was placed on books to a suitable height. Any camera may be used with a focus of the lens set at infinity, if adjustable. The film used was the regular Verichrome type. Pictures can be taken by using an arc light or sunlight. By using an arc light, the exposure is shorter and the intensity of light more constant. However, sunlight can be used just as successfully.

The method of taking the pictures now amounts to merely snapping the shutter. The

* Reprinted from *The Journal of Industrial Hygiene and Toxicology*, Vol. 21, No. 5, May, 1939.

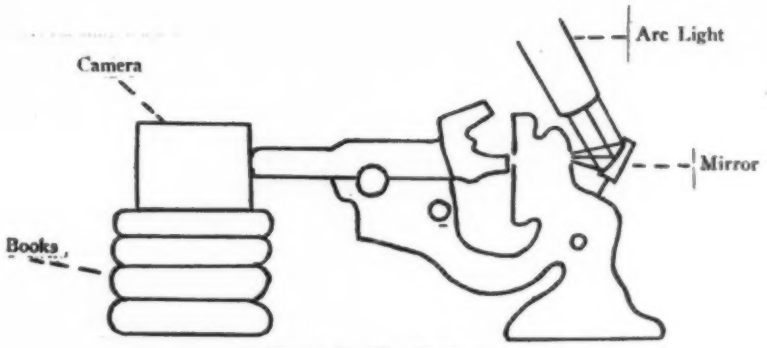


FIGURE 1.—The Projector.

length of exposure depends upon the intensity of light, transparency of the slide, and degree of magnification. In using a magnification up to about 340 the time of exposure, using an arc light, was about 1/25 of a second and with sunlight, 3 to 6 seconds.

Perhaps several attempts will be necessary to obtain desired results, but the method is inexpensive and there is a great deal of pleasure and satisfaction derived from the work.

Microprojector.—Here is a simple and cheap but quite effective microprojector.

All that is necessary is a source of fairly intensive light (such as an arc light), a microscope, and a screen. The screen may be merely of white cardboard. Using the set-up as shown in the diagram, I have obtained a clear image of about 3 feet in diameter, and with a very dark room, this has been enlarged to about 5 feet in diameter without loss of clarity.

The values of microprojection lie in the necessity of buying only one microscope and the ability to point out specific parts of the image to the whole class for discussion. I am now using this method with classes of 30 to 35 pupils with satisfactory results.

GORDON M. DUNNING,
Middletown High School,
Middletown, New York.

Scientists Work Overtime.—The last bell sounded more than thirty minutes ago. To most students that was the end of school work for the day, but to five general science students it was the beginning of interesting work. It must be interesting for they come without a request and receive no credit or "extra" credit for their efforts.

One student is trying to blow a bubble on the end of a soft glass tube, two are measuring the force necessary to lift a kilogram weight with various pulley systems, and two are adjusting a thermostat in circuit with dry cells and a door bell. One boy must walk two miles because he would rather experiment than leave on the school bus. Almost every night from one to six students can be found working in the laboratory.

Our general science students are fortunate to meet in the laboratory once a week with but one

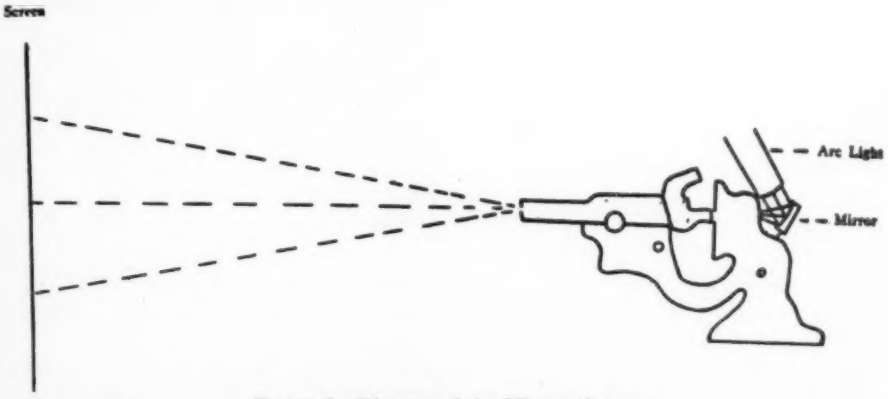


FIGURE 2.—Diagram of the Microprojector.

equipped science laboratory for a six year unit of five hundred students. Of necessity the one period is given to teacher demonstration, but after school the laboratory is open to all students who wish to experiment themselves.

Interest in individual experiments is constantly motivated in class. Time and time again the instructor suggests interesting experiments to do. Then after a student has completed an experiment he is often called upon to tell the class what he did and what happened. Also, the text suggests many more experiments than the teacher can demonstrate in one hour per week. In the beginning of the year the instructor often said, "If some one is interested in trying an interesting experiment after school . . . (describe the experiment) . . . we have the necessary materials." But this is no longer necessary.

The rules and regulations for after school experimenting are both few and simple. First, the student must have a good idea of what he wants to do and the procedure he must follow. Second, not more than eight students may work on any one night. Third, a student must work and not merely play. Fourth, he must give a report of his results to the instructor. This is usually a brief verbal report whenever the student and instructor meet. When a student works after school for the first time the instructor and student have a brief talk to impress the student that he has been granted a privilege which he is expected to treat as such.

Several students work more than once a week, others have worked just a few times, and more than half the students (56%) have worked at least once.

After-school work places an extra burden on the teacher, but the results are more than worth the effort. It is a real pleasure to feel that the students are sufficiently interested to work after school and to see the progress a few have made. We are not teaching to produce scientists but we hope a few will enter vocations that come from the realm of science. I am almost sure that I know who those few will be. They are the scientists who work overtime.

E. THOMPSON RICHARDSON,
Springfield High School,
Springfield, Pa.

Editorials and Educational News

TWENTY-FIRST ANNUAL MEETING OF THE NATIONAL COUNCIL ON ELEMENTARY SCIENCE

The National Council on Elementary Science will hold its twenty-first annual meeting in St. Louis on February 24, the Saturday preceding the meeting of the American Association of School Administrators of the National Education Association. The meeting will be held in the Crystal Room of the Jefferson Hotel.

This organization is offering a stimulating program. The entire program will deal with science in the elementary school.

The program follows:

Morning Session

"Emerging Methods in the Elementary School" by Gerald S. Craig, Teachers College, Columbia University.

"Emerging Curricula in the Elementary School" by Martin L. Robertson, New York University.

Round table during which Drs. Craig and Robertson will discuss questions from the floor.

Afternoon Session (joint meeting with the National Association for Research in Science Teaching)

"Elementary Science for Different Ability Levels" by Otis W. Caldwell, Emeritus Professor of Education, Teachers College, and General Secretary of the American Association for the Advancement of Science.

"Research and the Science Teacher" by Florence Billig, Wayne University.

THIRTEENTH ANNUAL MEETING OF THE NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

The thirteenth annual meeting of the National Association for Research in Science Teaching will be held on February 24, 25, 26 and 27, 1940, in St. Louis. Headquarters will be at the Jefferson Hotel.

On Saturday afternoon, the Association will hold a joint meeting with the National Council on Elementary Science. The program of this meeting is given in the previous announcement.

The annual dinner meeting of the Association will be held Sunday evening, February 25, at Hotel Jefferson. Immediately following dinner the officers and standing committees will make their reports and association business will be transacted.

At the morning session on Monday, February 26, the Association will meet as committee research groups in keeping with the plan adopted at the 1939 meeting. The tentatively chosen groups are as follows: (1) Curriculum, (2) Teacher Training, (3) Audio-Visual Aids, (4) Methods of Teaching, and (5) Evaluation. Temporary chairmen for the groups have been named and will formulate working plans in advance of the meeting. The meeting place and the personnel of each committee will be announced at the dinner meeting on Sunday.

The afternoon meeting on Monday will be given to a general program of the Association at which various research studies relating to the teaching of science will be presented.

On Tuesday, February 27, the research committees will assemble in morning and afternoon sessions to continue their work, make reports of their proceedings, and announce plans for the following year.

SCIENCE IN MODERN LIVING SERIES

This series includes both basic science material and suggestions for teaching. Its purpose is the improvement of science teaching in secondary schools by helping teachers trained in science to use their expertness in dealing with the significant problems of everyday life. The books are prepared in the Bureau of Educational Research in Science at Teachers College, Columbia University, by a group of experts in the various fields of science in collaboration with consultants in education, school administration, and evaluation.

The establishment of the Bureau in 1935 was authorized by the Dean of Teachers College and was made financially possible by a grant from the General Education Board. Associated with it are several cooperating schools where materials are tested in actual practice, and from which reports on experiences of many kinds are obtained.

The point of view underlying the work in the Bureau takes account of a democratic conception of human life and society, of the extraordinarily rapid changes in environment which modern science is bringing about, and of a conception of human capabilities as adequate to cope with these changes.

Material in the basic science volumes bears upon problems and issues of modern living and is arranged so as to serve the functional needs of students and adults today. Books now available in this group are *Life and Environment* by Paul B. Sears, of Oberlin College, *The Storehouse of Civilization* by C. C. Furnas, of Yale University, and *The Control of Organisms* by F. L. Fitzpatrick, of Teachers College.

Professor Sears offers an ecological approach to the study of environment and furnishes basic content for theory and practice in conservation. Professor Furnas discusses our natural resources from the standpoint of more effective production and distribution of goods and services with the aid of science and technology. Man's progress in making conditions favorable for the organisms he finds useful and unfavorable for those he finds harmful is the theme of Professor Fitzpatrick's book.

Other volumes in this basic science group will deal with the development of our ideas concerning the physical world, genetic nature of man, scientific attitudes, evolution, the social character of human nature, and the human life span.

Of the monographs on teaching suggestions, there is available *Suggestions for Teaching Selected Material from the Field of Genetics* by Anita D. Laton, of the Bureau of Educational Research in Science, and Edna W. Bailey, of the University of California. The material is intended to be of assistance to teachers in their classrooms. It includes a resume of the knowledge in the field and its relation to social problems, suggested activities for students, and means of evaluation.

The second monograph, *Selected Material from the Field of Sex Responsiveness, Mating, and Reproduction* by Dr. Laton and Professor Bailey, is ready for the press. It follows the same outline and contains the same kinds of material as *Genetics*.

Other *Suggestions for Teaching* now in preparation deal with life and environment, physiological exchange of material and energy, life span, scientific method, origin of concepts concerning changes in the motions of bodies, evolution, technological utilization of energy.

Samuel Ralph Powers, of Teachers College, is administrative officer of the Bureau of Educational Research in Science and editor of the series, which is published by the Bureau of Publications, Teachers College, Columbia University.

Abstracts

SCIENCE

STOKLEY, JAMES. "Christmas Stars." *Science News Letter* 36: 346–347; November 25, 1939.

Four planets — Venus, Mars, Jupiter and Saturn—are now visible in the winter sky. Jupiter and Saturn are now in the Constellation Pisces. Mars is in the neighboring Constellation Aquarius. In February, 6 B.C., these three stars were in the Constellation Pisces, and may have been the Star of Bethlehem that guided the Wise Men. Or the Star of Bethlehem may have been a nova, a comet, a meteor, or something entirely different. We really do not know.

—C.M.P.

HARDING, T. SWANN. "The Great American Rite." *Scientific American* 161: 26–27; July, 1939.

The writer quotes several medical opinions seriously questioning the widespread practice of tonsillectomy. The same protest applies to the reckless removal of teeth. A person having a lot of tonsillitis and sore throat gets definite benefit from the operation; a person with none gets none.

—C.M.P.

CLOSE, UPTON. "More Oil from Crooked Wells." *Scientific American* 161: 84–87; August, 1939.

Drilling deliberately crooked oil wells instead of straight ones promises to add immeasurably to the dwindling oil resources of the world. The Eastman slant-drill method not only taps otherwise impossible sources, but also has been used successfully to kill wild wells.

—C.M.P.

GREENSTEIN, JESSE L. "The Space Between the Stars." *Science Digest* 6: 45–48; August, 1939.

This article is condensed from the May–June, 1939, issue of *The Telescope*. It is estimated that a cubic mile of interstellar space contains between 1 and 100 tiny dust particles. So rarefied is interstellar space that the contents of a volume of space as large as the earth would weigh but 2 pounds.

—C.M.P.

ELLSWORTH, LINCOLN. "My Four Antarctic Expeditions." *The National Geographic Magazine* 76: 129–138; July, 1939.

In this article, the noted author describes his four Antarctic expeditions which cost $400,000 and whose sole purpose was the exploration of the interior of Antarctica, two-thirds the size of North America. Needless to say, much valuable information was obtained about this practically unknown continent.

—C.M.P.

COTTON, F. BARROWS. "News of the Universe." *The National Geographic Magazine* 76: 1–32; July, 1939.

This article comments upon various aspects of astronomy—sunspots, their cause and effects, Mars and its possibilities of life, the origin of the solar system, meteorites, the milky way, Nebula and the depths of space. There are 33 illustrations, 10 of which are paintings by Charles Bittinger. The latter are unusually fascinating.

—C.M.P.

HOLMES, CHARLES H. "Australia's Patchwork Creature, The Platypus." *The National Geographic Magazine* 76: 272–282; August, 1939.

An unusually interesting article about this strange duck-billed animal with a fur coat, which lays eggs and suckles its young. There are 13 illustrations.

—C.M.P.

ROBINSON, J. "Change in the Earth's Surface." *Discovery* 2: 490–496; September, 1939.

Changes in the earth's surface have been many in the past and are continuing in the present. There is some evidence to indicate the Americas were once joined to Africa and Europe. At present the Alps are moving northward, northeast Sweden is rising about one foot in 25 years while southern Sweden and Denmark are steadily sinking into the sea.

—C.M.P.

ANONYMOUS. "How Will the World End?" *Popular Science Monthly* 135: 58–59, 222; September, 1939.

This article discusses possible ends to the earth—burning due to increase of sun's heat, freezing due to decrease of sun's heat, collision with a body from space, and explosion of the moon upon near approach of the moon to the earth.

—C.M.P.

MAYBEE, G. R. "These Elusive Flavors." *Science Digest* 6: 8–12; August, 1939.

This is condensed from the March, 1939, issue of *Canadian Chemistry and Process Industries*. Flavor is a mingled sensation of smell and taste. Often we really smell the food when we think we taste it. The most bitter substance known is brucine which is about 1000 to 1250 times as bitter as quinine. It is so bitter that its taste can still be detected when 1 part is dissolved in 200,000 parts of water. Only four kinds of taste sensations recognized by physiologists are: sweet, sour, bitter, and salt. The four kinds of odors are: fragrant, acid, burnt, and caprylic. (Abstractor's note: Henning, one of the world's authorities,

gives the following six: spicy, flowery, fruity, resinous, burnt, and foul.) —C.M.P.

DOUGLASS, IRWIN B. "Some Chemical Features of Yellowstone National Park." *The Journal of Chemical Education* 16: 422–435; September, 1939.

Yellowstone Park affords an unparalleled opportunity to study some of the chemical reactions that take place in nature's laboratory. The reacting substances in Yellowstone are the gases rising from the uncooled magmatic masses far below the surface, the characteristic rocks of the region, the ground water, and the atmospheric oxygen which interacts with certain gases and solutions brought to the surface. There are several excellent photographs.

—C.M.P.

SEWARD, ALBERT. "The Western Isles Through the Mists of Ages." *Science* 90: 189–200; September 1, 1939.

This is a very interesting article on the study of plant life, ancient and modern, found in the northern hemisphere. It is very difficult to account for the great similarities in plant life in widely separated areas. Floating continents would give a reasonable explanation, but it remains for the future to give us a specific answer as to whether the Wagnerian theory of floating continents is correct.

—C.M.P.

MURPHY, ROBERT CUSHMAN. "Whitney Wing." *Natural History* 44: 98–106; September, 1939.

This is a brief description of the new home of the American Museum's Department of Birds. Twelve excellent photographs enhance the interest in the article.

—C.M.P.

CLARK, JAMES L. "The Big Tom of Beaver Dam Wash." *Natural History* 44: 83–93; September, 1939.

This is the story of a thrilling lion hunt in our own West to obtain lions for the American Museum's Monumental North American Hall.

—C.M.P.

ANONYMOUS. "The Cycle of Life." *Natural History* 44: 96–97; September, 1939.

This is an excellent chart giving interesting information about 49 mammals. From the baby opossum weighing only 1/140 ounce to the 7-ton new-born whale, animals show great diversity in their birth. The animals are arranged according to the length of the period before birth. The opossum takes only 13 days in the womb, the elephant almost 2 years. Generally speaking animals which require a longer period before birth live longer. The whale weighs 6 times as much as its offspring, the kangaroo 3,000 times. The chart gives the length of period before birth, the span of life, weight at birth, weight of adult male, and the number born.

—C.M.P.

YUDKIN, JOHN. "Blood Transfusion." *Discovery* 2: 511–514; October, 1939.

Blood transfusion dates back to 1615. During the following fifty years several successful transfusions, using animals, were made. A storm of protest arose and the practice was abandoned for the next 150 years. Blood typing as a precedent to transfusion was first made a routine procedure in 1914. Stored blood is being used quite extensively now. —C.M.P.

WHITCHER, CHARLES E. "Do Americans Like Snakes?" *Hobbies* 20: 6; October, 1939.

The author makes a plea for the conservation of snakes. The United States has four poisonous snakes: the rattlesnake, copperhead, water moccasin, and coral snake.

—C.M.P.

PRENTICE, E. PARMALEE. "Food and Famine of Our Ancestors." *Science Digest* 6: 63–68; October, 1939.

This is condensed from the book, *Hunger and History*. Famines used to be the usual thing, rather than the unusual. Periodical famines were long the scourge of Europe. A great step forward in preventing hunger was the cultivation of edible herbage and roots during the Elizabethian period.

—C.M.P.

MACKAY, CHARLES. "Strange Popular Delusions." *Science Digest* 6: 77–82; October, 1939.

This is condensed from the book, *Extra-ordinary Popular Delusions and the Madness of Crowds*. The article records many strange popular delusions that have haunted the lives of people—the end of the world, witchcraft, and so on. Progress has been made, but we are not out of the woods as yet.

—C.M.P.

HODGE, HENRICKS. "The Dr. Jekyll and Mr. Hyde of the Plant World." *Natural History* 44: 160–165; October, 1939.

The nightshade family truly represents a strange family of plants, having some of the most poisonous plants, and also some constituting our main food supply. The poisonous plants include thorn apple, belladonna, black henbene and datura metel. Valuable members of the family include white potato, tomato, red pepper, and tobacco.

—C.M.P.

VON HAGEN, V. WOLFGANG. "The Lost Jicaques." *Natural History* 44: 168–177; October, 1939.

This is the story of an ancient Indian tribe deep in the Hondurian rain forest into whose palisaded settlement even the neighboring natives (let alone foreigners) had not previously been allowed to enter. They feared contagious diseases, especially the common cold. The author and his party made friends with them and learned much about this previously unknown group.

—C.M.P.

POULTER, THOMAS C. "Research on High Pressures." *Scientific American* 161:202–203; October, 1939.

Until recently pressures as high as 1,000,000 pounds a square inch were a laboratory curiosity, but rather common in the natural world. The effect of high pressures are now being studied extensively. Such studies include the effect of pressure upon the chemical reaction of sulfuric acid on zinc, pressure on living organisms, pressure on glass, and pressure upon various properties of matter.

—C.M.P.

CLARKSON, RICHARD B. "Cuba—Key to Manganese Problem." *Scientific American* 161: 210–211; October, 1939.

Cuba today holds what may be the most important single key to America's national security in time of war. Manganese has been rated number one in importance of all strategic war materials. It is vital in manufacturing steel. A new flotation process makes Cuban manganese ore available. The United States imports all its manganese. In 1931, we obtained 1 per cent of our manganese imports from Cuba—in 1938, we obtained 25 per cent. There could easily come a time when we would be willing to trade all our gold buried in Kentucky for manganese.

—C.M.P.

BASTIN, HAROLD. "Camouflage in Nature." *Discovery* 2:561–568; November, 1939.

The art of not being noticed has been brought to the greatest degree of refinement by many otherwise unprotected insects and animals. This article explains why nearly all birds are lighter in color on their underparts, how a caterpillar contrives to look like nothing, and how stick insects have developed a habit of falling into a trance in order to keep still. There are several excellent photographs.

—C.M.P.

BAGNOLD, MAJOR R. A. "A Lost World Refound." *Scientific American* 161:261–263; November, 1939.

On a high plateau far in the Sahara, archeologists have discovered evidence of early man's culture. For several hundred thousand years, men of the lower and middle Paleolithic Age roamed over this region trapping game and chipping stone implements. The region was then wet and fertile. At some unknown date, many thousands of years ago, the people of the North African plains began to domesticate cattle and to pasture herds on the thinning grass. Finally, about 5000 to 10,000 B.C., came the final desiccation of the region and man had to abandon these plains. Now only cave paintings, crude implements, and tracks made thousands of years ago remain in this static world. To go there is almost like being on another planet.

—C.M.P.

NEWMAN, BARCLAY MOON. "Cancer's Mysterious Puzzle." *Scientific American* 161:278–280; November, 1939.

About 150,000 people die each year from cancer. Although much research has been done, the cause and cure for cancer still baffles the scientist. Occupational cancer occurs among workers employed in the distillation of coal tar, among workers who spread tar on roads, workers exposed to shale and lubricating oils, and workers in certain aniline dye factories. Research has found more than 50 different cancer producing chemicals.

—C.M.P.

PRATT, FLETCHER. "Solving Secret Writings." *Science Digest* 6:33–38; November, 1939.

This is condensed from the book, *Secret and Urgent*. It is an interesting article on how secret code writings are deciphered. Secret writing intrigues many people.

—C.M.P.

SMITH, HOMER W. "The Lungfish." *Natural History* 44:224–225; November, 1939.

This is the story of a lungfish which made a 10,000-mile trip from Nairobi, Africa, in a dry cake of mud, and lived "to tell the tale." The lungfish is a survivor of the Devonian Period, 300 or 400 million years ago.

—C.M.P.

COBB, WILBURN DOWELL. "The Pearl of Allah." *Natural History* 44:196–202; November, 1939.

The sacred pearl of Allah was presented to the author by a Mohammedan chief whose son he saved from death. It is the world's largest pearl, weighing 14 pounds. Illustrated.

—C.M.P.

PARRAN, SURGEON GENERAL THOMAS. "Our Common Diseases." *Journal of the National Education Association* 28:275–276; December, 1939.

The following diseases are briefly described as to symptoms, cause, and care: common cold, constipation, measles, scarlet fever, diphtheria, lobar pneumonia, smallpox, tuberculosis, appendicitis, athlete's foot, gonorrhea, and syphilis.

—C.M.P.

ANONYMOUS. "Discover How and Where Body Makes Its Germ Fighters." *Science News Letter* 36:355; December 2, 1939.

Dr. Florence R. Sabin of Denver reports that antigens marked with dye protein come to rest in blood vessels in the liver, spleen, and bone marrow.

—C.M.P.

BURTON, WALTER E. "Abandoned Mine Yields Mushroom Gold." *Popular Science Monthly* 136:82–83; January, 1940.

Near Ellwood City, Pennsylvania, is found one of the world's first electrically heated mushroom beds. The bed is in an old abandoned mine hav-

ing a constant all-the-year-round temperature of fifty-two degrees. The mine covers 144 acres and has a 23 acre lake of water in it. It is possible to drive a car for miles in the mine without seeing daylight. Mushrooms in electrically heated beds mature in 6 days against the usual 64 days. Production often exceeds a ton of mushrooms a day.

—C.M.P.

MCKAY, HERBERT C. "The Miniature Camera." *American Photography* 33: 536–540; July, 1939.

This article gives some very practical advice about the buying and use of a miniature camera. A too-fast lens is not advisable for the amateur.

—C.M.P.

LAKE, THOMAS P. "Infra-Red is for Amateurs, Too." *American Photography* 33: 522–527; July, 1939.

Amateur photographers can use infra-red film the same as professionals. Sometimes it is possible to take better pictures, and often to take pictures that would be impossible without the use of infra-red film.

—C.M.P.

VON ERTZ, WOLFGANG. "Birds of War." *Minicam* 2: 22–23; July, 1939.

This article describes the use of carrier pigeons as aerial photographers. Light cameras are attached to the pigeons. These are timed so as to take pictures at regular intervals. The advantages are obvious.

—C.M.P.

MORTENSEN, WILLIAM. "Lighting the Outdoor Portrait." *Camera Craft* 46: 299–306; July, 1939.

In general, the making of outdoor portraits involves four main problems. These are: (1) the manipulation of the camera, (2) light, (3) background, and (4) selection and arrangement of material.

—C.M.P.

BURT, RUSSELL J. "Printing-In Clouds." *American Photography* 33: 600–03; August, 1939.

This article describes an easy and effective method of printing-in clouds from separate negatives.

CHACE, LYNWOOD M. "How to Film Nature." *Minicam* 2: 48–53; August, 1939.

Some interesting, practical advice on photographing nature subjects is presented in this article.

—C.M.P.

MCKAY, HERBERT C. "The Miniature Camera." *American Photography* 33: 622–625; August, 1939.

This article includes some very practical advice about miniature negatives and making miniature prints.

—C.M.P.

PICKERING, ROBERT L. "Television—A Cameraman's Headache." *Camera Craft* 46: 420–425; September, 1939.

Technical and practical difficulties in the photographic phase of television are described in this article.

—C.M.P.

WESTON, EDWARD. "Thirty-Fve Years of Portraiture." *Camera Craft* 46: 399–408, 449–460; September and October, 1939.

This is a most interesting article by one of America's best portrait photographers. The article is illustrated by several of his excellent portraits.

—C.M.P.

OBERLIN, WILLIAM A. "Overexposure and Underdevelopment." *American Photography* 33: 728–740; October, 1939.

One of the oldest rules in photography is "Expose for the shadows and develop for the highlights." Practical applications of this motto are presented in this illustrated article.

—C.M.P.

MISHELL, ROBERT. "I Made A Mural." *American Photography* 33: 721–728; October, 1939.

This article describes the process of making a most interesting photographic mural.

—C.M.P.

WRIGHT, JACK. "Introduction to Infra-Red Photography." *Camera Craft* 46: 469–475; October, 1939.

This is a practical, illustrated article for the beginner in the use of infra-red film.

—C.M.P.

MORGAN, WILLARD D. "The Larger Camera." *U. S. Camera* 1: 56–60; October, 1939.

This is the second half of a camera analysis, comparing the features of roll film, cut film pack and view cameras in the larger sizes. Such information as picture size and film size, type of shutter and speeds, lens and focal length, type of finder, method of focus, body construction, dimensions closed, weight, distributor, special features, and price are given. Most models are illustrated.

—C.M.P.

FISK, HARRISON. "Miniature Cameras." *American Photography* 33: 851–865; November, 1939.

This article lists a comparative chart of available miniature cameras—name, size, lens, body type, shutter, method of focus, special features, size of negative, and price and distributor.

—C.M.P.

WALLACE, BOB. "Photos on All Fours." *Camera Craft* 46: 563–573; December, 1939.

This illustrated article describes practical procedures for taking good pictures of animals. The main thing to remember when you are getting ready to take the picture of any animal—tame or wild—is: "Don't get excited." As soon as you start moving fast or making a lot of noise your subject will get scared.

—C.M.P.

SECONDARY SCIENCE

BINGHAM, N. E. "The Environment as a Science Laboratory." *Teachers College Record* 40: 725–735; May, 1939.

If the secondary school is to challenge the adolescent, the curriculum must be vitalized. Why not use the environment as a science laboratory? The author discusses problems involved in taking excursions and study trips: leadership, school schedules, costs, and liability. Possible types of excursions, brief, half-day, whole-day, week-end, and extended excursions are discussed. Excursions and study-trips offer possibilities that, as yet, have been seldom utilized. —C.M.P.

SIMMONS, MAITLAND P. "A Father-and-Son Exhibit." *School Activities* 11: 95–96; November, 1939.

The author describes a father-son science project—a model of the San Francisco-Oakland Bay bridge. Such projects would seem to offer new possibilities of interesting parents in the science classwork. —C.M.P.

HENDRICKS, B. CLIFFORD, AND HANDORF, B. H. "New Examinations from Old." *The Journal of Chemical Education* 16: 329–332; July, 1939.

In a questionnaire study, one of the authors found that about 65 per cent of general college chemistry teachers used old examination questions. The first mentioned author keeps a "question scrap book." Item difficulty records are also included. Validity of test items also has been recently added to the test file. There have been suggestions that a cooperative question evaluation service among colleges would serve a most useful purpose. —C.M.P.

FRUTCHEY, FRED P., AND HENDRICKS, B. CLIFFORD. "The Essay Examination in Chemistry." *The Journal of Chemical Education* 16: 491–493; October, 1939.

In spite of recent interest in other examination forms, the essay question is more used than all forms combined. The advantages and disadvantages of essay-examinations are discussed. The reliability and objectivity of such tests can be greatly improved if certain precautions are taken. —C.M.P.

RENNER, GEORGE T. "The Map In Modern Education." *Teachers College Record* 40: 703–724; May, 1939.

This is an excellent article on the history and classroom use of various types of maps. —C.M.P.

PUTERBAUGH, M. P. "The Chemistry Methods Course." *The Journal of Chemical Education* 16: 380–383; August, 1939.

Methods courses should introduce the prospective science teacher to the many problems, duties and devices that make up classroom and laboratory experiences. Such topics as objectives, lesson plans, class and laboratory relations, purchase and care of equipment, and aids in maintaining interest are discussed. Students receive experiences in making up solutions, and helping in the stock room, laboratory, and classroom. —C.M.P.

LUDLUM, ELBERT M. "A High School Course in Photography." *Better Photography* 2: 42–44, 46–51; October, 1939.

This is a simplified "learn by doing" course adapted to a beginners' class in high school photography, either as a part of the regular classroom work, or as part of the activities of a science club or photography club. —C.M.P.

PRATT, J. G. "The Use of Cocaine and Ether in Photographing Live Insects." *American Photography* 33: 914–918; December, 1939.

Cocaine and ether are used in photographing insects by the author, who is Chief Photographer of the Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture. —C.M.P.

LUDLAM, ELBERT M. "High School Outline for Photography." *Better Photography* 2: 18–20, 22, 26; December, 1939.

This is a brief outline for a high school course in classroom photography. High school science clubs could use the outline effectively, too. —C.M.P.

WOODCOCK, WILSON. "The Teaching of Photography." *The American Physics Teacher* 7: 394–397; December. 1939.

Photography courses in science departments should have as a primary emphasis the making of better pictures and not the exposition of physical principles for their own sake. The article includes a list of topics for 15 recitations and a list of 7 projects. —C.M.P.

WALLING, MORTON C. "Jungles on Stale Bread Explored with Your Microscope." *Popular Science Monthly* 135: 186–189, 220; August, 1939.

This article describes the kinds of molds commonly found on bread, and how to best handle, mount, and preserve specimens. —C.M.P.

CLARKSON, PAUL A. "Chemical Magic Creates New Riches from Coal." *Popular Science Monthly* 135: 39–41, 210; August, 1939.

The following products are made from coal at a Du Pont chemical factory at Belle, West Virginia: Coke, gas, artificial silk, refrigerants, fertilizers, plastics, auto antifreeze, ingredients of auto brake fluids, liquids for ore flotation and mold preventive for bread. —C.M.P.

STEIL, W. N. "How Ferns Grow." *The Science Counselor* 5: 75–78, 87–88; September, 1939.

This is an excellent article with twenty-seven illustrations, describing the development of the fern. —C.M.P.

HARPER, SAMUEL A. "The People vs. Corvus." *Biology Briefs* 2: 30–31; October, 1939.

This is a reprint of an article from *The Chicago Naturalist*. The author pleads the case of the crow and describes the important work of the Bureau of the Biological Survey. —C.M.P.

SCHIFF, DAVID. "Teaching Scientific Method and Attitudes." *The Teaching Biologist* 9: 6–7; October, 1939.

The author discusses possible means of teaching scientific methods and attitudes to high school students. —C.M.P.

SYMPOSIUM. "Teacher Demonstration Material." *The Science Classroom* 18: 1; July, 1939.

This is the last of a series of original demonstrations presented by science teachers at a recent meeting in New York City. Since 1934, nearly 200 new demonstrations and pupil projects have been described in *The Science Classroom*.

The two demonstrations described in this issue are: (1) "The Use of Oxygen by the Body" by Nathan Levy, and (2) "Food is a Fuel" by Charles A. Grumet.

—C.M.P.

JOHNSON, LEROY D. "Its Right Here for You." *The Science Leaflet* 13: 35–39; September 14, 1939.

This is a chemical playlet suitable for a school assembly or science club. The playlet is historical. —C.M.P.

MEISTER, MORRIS. "Popular Science in the Classroom; A Project for Every Science Club; and Learning by Doing." *The Science Classroom* 19: 1, 1, 1,; October, November, and December, 1939.

These three articles describe teaching material that science classroom teachers will find most helpful. The material parallels rather closely the material found in *Popular Science Monthly* for that month.

—C.M.P.

JAEGER, ELLSWORTH. "How to Know Footprints." *Natural History* 44: 226–232; November, 1939.

This is an illustrated article that tells how one may learn to know the footprints of various animals.

—C.M.P.

SYMPOSIUM. "Outline of a Teaching Unit on Mankind." *The Teaching Biologist* 9: 27–44; November, 1939.

This outline was planned and written by the Anthropology Study Group of the New York Association of Biology Teachers. The outline includes: (1) a statement of educational premises, (2) a list of generalizations, (3) understandings, (4) learning activities, (5) sources of teaching aids, such as museums, visual aids, and periodicals, (6) a lesson plan, (7) an evaluation technique, and (8) a selected bibliography.

—C.M.P.

WALLING, MORTON C. "Exploring Insect Eyes with Your Microscope." *Popular Science Monthly* 135: 212–215, 246; November, 1939.

This article describes the technique of obtaining and mounting insect eyes for observation with the microscope. —C.M.P.

SIMPICH, FREDERICK. "Chemists Make a New World." *The National Geographic Magazine* 76: 601–640; November, 1939.

This is an excellent article showing how chemistry has and is disrupting old trade routes, and is revamping the world map of industry. There are 22 illustrations and 26 natural color photographs by Willard R. Culver. The content, illustrations and photographs make this one of the finest supplementary articles for the secondary chemistry or the physical science survey class that the abstractor has chanced upon in a long time. —C.M.P.

ANONYMOUS. "Seeing Nature's Laws in Action." *Popular Science Monthly* 135: 210–211; December, 1939.

The following experiments are described: (1) lamp bulbs demonstrate laws of resistance, (2) cardboard model shows how range finders work, (3) why dirty snow melts faster than clean, (4) seeing through a fence, (5) what is specific heat? and (6) compass needle swings like a pendulum. —C.M.P.

WAILES, RAYMOND B. "Chemical Analysis for Amateurs." *Popular Science Monthly* 135: 202–205, 246; December, 1939.

This article describes several interesting chemical tests such as a test for detecting borax, butter, mineral oil, the halogens, caffeine, and copper in alloys. —C.M.P.

SHULMAN, WILLIAM. "The Causes of Autumn Coloration." *The Teaching Biologist* 9: 60–61; December, 1939.

The yellow colors of autumn leaves are due to carotinoids (principally to xanthophyll); the red coloration is due to anthocyanin. The varying combinations of different proportions of xanthophyll, carotin and anthocyanins give the multitude of inter-grading shades of orange, yellow, red, red-orange, etc. As the autumn draws on, a layer of cork known as an "absciss layer" forms at the base of the petiole of the leaf. This brings about the death of the leaf, independently of the frost. —C.M.P.

WAILES, RAYMOND B. "Fun in the Laboratory." *Popular Science Monthly* 136: 201–203, 235; January, 1940.

Numerous chemical stunts are described in this article such as crystallization taking place instantly at the touch of a stick, growing chemical whiskers, "rhythmic" crystallization, "traveling" precipitate, and self-luminous solutions.

—C.M.P.

New Publications

WHITMAN, WALTER G. *Household Physics.* New York: John Wiley and Sons, 1939. 423 p. $3.00.

This is a complete revision of one of the best of the household physics texts. Six new chapters have been added, the organization improved, and all material brought sharply up-to-date. Although emphasizing applications in the home, it is much more than this, leading through first hand experience to the fundamental principles of physics. In the reviewer's opinion this type of organization and approach will prove of much greater value to ninety-five per cent of the high school population than the traditional classical physics organization. As conditions are, only a little over five per cent of our high school population receives the advantage of a course in physics, largely because the courses offered are designed to meet the needs of the small group planning to continue their education in college. Has physical science no contribution to make to the preparation for living of the other ninety-five per cent? This book is an affirmative answer.

—O. E. Underhill.

SEARS, PAUL B. *Life and Environment.* New York: Bureau of Publications, Teachers College, Columbia University, 1939. 167 p. $1.85.

This is an interpretation of situations and problems arising out of the interrelations between human society and its living and non-living environment. It is by no means an ecology text, but rather presents broad relationships in such a way that the teacher or student of science may fit the facts he may learn into a sociological framework. It presents the broad relationships of man and his society; plants, animals, soil, air, rain, heat, cold, fire and wind, so that the reader may recognize the effects of change, and see wherein he should direct his efforts to further those which are constructive, and arrest those that are destructive, in terms of their significance to society. Chapter titles indicate the scope: (I) Life and Environment Inseparable, (II) A Phase of Advancing Human Culture, (III) The Main Divisions of Environment, (IV) Human Society as Environment, (V) The Community, A Moving Equilibrium, (VI) The Working Organism in the Community, (VII) The Nature of Ecology, and (VIII) Ecology in the Service of Society. An appendix of twenty pages offers some suggestion as to the significance of this material to the teacher and some reading suggestions. This is the first of the *Science in Modern Living Series* under the editorship of S. R. Powers dealing with basic science materials and their use as part of a program of general education.

—O. E. Underhill.

LATON, ANITA D., BAILEY, EDNA W., SCHWAB, JOSEPH AND DIEDERICH, GERTRUDE WYLIE. *Genetics.* New York: Bureau of Publications, Teachers College, Columbia University, 1939. 66 p. $0.50.

This is the first monograph of *The Science in Modern Living Series,* edited by S. R. Powers, under the general title *Suggestions for Teaching in Modern Education.* It is a summarization, in one area, of much thought and experimental teaching which had for its purpose the selection and evaluation of science materials which would really function in meeting the needs of the average individual as he progresses through his educational experiences from elementary school through college. This monograph and others to follow offer suggestions for teaching designed to accompany basic science materials now being published as part of *The Science in Modern Living Series,* those now in print being *Life and Environment* by Paul B. Sears, *The Storehouse of Civilization* by C. C. Furnas, and *The Control of Organisms* by F. L. Fitzpatrick. This is not a series of lesson plans for any one class. "It offers suggestions from which a teacher and his class may select activities of interest to them and which will start the group thinking about learning activities of interest to them and which will start the group thinking about learning activities even more significant for them than the ones described." The chapter headings indicate the scope of the monograph: (I) Questions, Misconceptions, and Interests Related to the Field of Genetics, (II) What Students May Learn from Genetics, (III) Introducing Work in Genetics Relating to Questions, Misconceptions, and Interests of Young People, (IV) Activities Useful in the Study of Genetics, (V) Evaluation of Results from Teaching and Learning in Genetics, and (VI) Selected Material from Genetics Bearing on Socially Important Controversial Topics. There are nine pages of annotated bibliography.

—O. E. Underhill.

DONNISON, C. P. *Civilization and Disease.* Baltimore: William Wood and Company, 1938. 222 p. $3.00.

Out of years of experience as medical officer in charge of a native reserve far from civilization, followed by experience as medical practitioner in England, Dr. Donnison has attempted to interpret many diseases "as products of a change in biological environment,"—civilization. Following an inquiry into the relationship between civilization and disease, the distribution of specific diseases is studied under the two groups classed as (1) organic, (2) functional disorders usually classed under the heading of the psychoneuroses. On the basis of objective evidence of the close relation-

ship of the psychoneuroses with civilization, the theories are examined in the light of emotional relationships between the individual and his environment.

Along with the benefits accruing from cultural advance, as an adventitious growth is an increasing incidence of disease of certain types "which appear rather as by-products of a process of adaptation that is taking place, and are probably indicative of the imperfection of that adaptation. The solution of the problem of the incidence of these diseases can be found in careful regulation of the influence of social heredity."

Statistical evidence has been used from Colonial Medical Services for the colonies of Kenya, Tanganyika, Uganda, Nyasaland, Malaya, Straits settlement, Nigeria and Gold Coast. A detailed list of references follows each chapter.

—L.M.S.

QUAYLE, HENRY J. *Insects of Citrus and Other Subtropical Fruits.* Ithaca, New York: Comstock Publishing Company, Inc., 1938. 583 p. $5.00.

This is a valuable book to the grower of subtropical fruits, and to students of horticulture and of economic entomology. In addition to insects other enemies of subtropical fruits such as mites, rodents, nematodes and snails are included. A complete life history of each animal is given along with its habitat and other details of interest, followed by chapters on fumigation, spraying and dusting, and domestic plant quarantines pertaining to subtropical fruit insects.

A large number of excellent drawings and photographs enhance the value of the book.

—L.M.S.

HOLME, C. G. (Editor). *Modern Photography.* New York: The Studio Publications, 1939. 136 p. $3,50, Cloth; $2.50, Paper.

This is the 1939–40 *Studio Annual of Camera Art.* As always, this annual represents the best photographs of the year. As this is the hundredth year of photography, unusual care has been taken to select pictures that would truly represent the best in photographic art, and all who glance through this annual must admit that photography today is truly artistic.

There is an article by E. A. Robins surveying the century of photography, with reproductions of the early masters. There are 84 reproductions in black and white including a section of scientific photographs. There are 8 reproductions in color. There is a section on the "new Photo-journalism." This includes 21 examples in monochrome of photo-reportage. Full technical details of each photograph is included.

—C.M.P.

HOLME, C. G. (Editor). *Photography for Commerce.* New York: The Studio Publications, Inc., 1939. 147 p. $3.00.

This is the second volume in *The Studio Camera Art Series.* The book offers a survey of the best work already accomplished in commercial photography. This book shows the great progress that has been made in advertising photography, and by contrast indicates the progress yet possible in advertising photographs commonly found in newspapers and magazines. One of the greatest handicaps to advertising by photographs is the quality of paper commonly used in newspapers, and quite often in magazines. Whether or not this handicap will ever be overcome to any large degree is rather questionable. This book vividly portrays the great possibilities in its 148 excellent photographs, some in color. Commercial photography offers great possibilities and requires skills and techniques as high as that found in any division of photography.

—C.M.P.

ANONYMOUS. *Photographic Almanac for 1939.* Chicago (230 South Wabash): Central Camera Company, 1939. 258 p. $0.25.

This is primarily a source book for the obtaining of photographic supplies but there are numerous articles and "helps" on various phases of photography.

—C.M.P.

GEORGE, WILLIAM H. *The Scientist in Action.* New York: Emerson Books, Inc., 1938. 354 p. $3.00.

Science is the product of the scientist in action. It is therefore a biological product. The biological factor in its production has been largely ignored. But "in interpreting the results of research it becomes necessary to examine to what extent they depend upon the human factor." Men's senses are notoriously inaccurate and unreliable. So the scientist has come to rely on coincident observation. Temperature is read by noting the coincidence of the top of the mercury column with a mark on a scale. The results of such observations by different observers agree. They give us facts. The scientist then fits these facts together into patterns which we call generalizations, laws, theories and the like. When so doing, the scientist is patterning. The patterns which he thus achieves are conditioned by the nature of the scientist in action. If he is visual minded, the patterns will be in terms of pangens or of atoms that are discrete particles. If he is mathematically minded, the patterns will take the form of formulae and equations. The patterns which he gets are not to be judged true or false any more than a mosaic is to be called one or the other. You can tear up a mosaic and use the little blocks to make another quite as satisfying or even more so. Similarly facts can be combined into a variety of patterns. "I am unable to attach any definite meaning to a claim that any particular explanation of a subject is *the* explanation or the correct, or true, or probably true, or real, or only scientific explanation of the subject."

This rather unusual viewpoint does not detract from the value of the author's keen analysis of

the mental processes of the scientist in action nor his able discussion of the sources of error in observation, abstraction, theorizing and the like. The real scientist will read the book with pleasure and profit, for the author's perspicuity is remarkable. It is not a book for the amateur unless he is willing to work hard upon it.

—E.R.D.

BERNAL, J. D. *The Social Function of Science.* New York: The Macmillan Company, 1939. 482 p. $3.50.

It is a big book, some 250,000 words. The print is fine, too fine in foot notes and quotations. Its sub-title—"What Science Does; What Science Could Do"—is more indicative of its contents. Because of the division the treatment is somewhat repetitious.

It is refreshing to find a book that is critical of the conduct of science. Most writers afford it such fulsome praise that Mr. Everyman regards Science almost as a halo-ed divinity. The author maintains that the funds available for science are totally inadequate, that research in the field is badly administered, lacking coordination and intelligent direction, that the research worker is handicapped by lack of freedom and adequate support. Science has been forced against its best judgment to serve in the interests of unfair industrial competition, want in the midst of plenty, war. Science education is lacking for most pupils and fails to provide changes in the students who do get it, that assure their social adjustment at all commensurate with what science now knows. The author's opinions on all these items and many others are backed up by ample facts.

The second part on what science could do is optimistic, occasionally, perhaps, visionary. But it renews ones faith in Youth. The author is a young man. The oncoming generation will find a way to move ahead to better things. Chapter XII on the "Strategy of Scientific Advance" gives a survey of recent scientific discovery that, though brief, is very helpful in fields foreign to the specialist. You will read "Science in the Service of Man," Chapter XIV, with keen appreciation. The author offers not vague suggestions but very concrete recommendations on the application of science to problems meeting human needs. Some of these are audacious, but we need audacity to set us thinking hopefully. The review of the conditions of science and of science education in several countries is very flattering to Russia.

The book is highly recommended. You may beg to differ with the author on some, perhaps on many, points but it will stimulate a lot of thinking.

—E.R.D.

ROSSKAM, EDWIN. *Washington, Nerve Center.* New York: Alliance Book Corporation, 1939. 144 p. $2.50.

Two million tourists visit Washington, D. C., annually. They see the Capitol, the White House, the Washington Monument, Arlington, Lincoln Memorial, Mount Vernon, and possibly the Congress, and the Supreme Court in action. According to the author the purpose of this book is "to show in word and in picture the function of the national capitol as it reaches into every farm, town, home, and life. It is the story of Democracy in action."

The author has accomplished a most worthwhile task. The book is informational, picturesque, inspirational. Truly the chief business of Washington is government. What a nerve center Washington really is, is graphically presented in this book. This is an excellent book for supplementary reading in geography and for all American citizens. The numerous, excellent photographs (196 in all) together with much interesting information, make this a book that is a pleasure to read and to glance through.

—C.M.P.

Federal Writers Project. *Our Washington.* Chicago: A. C. McClurg and Company, 1939. 179 p. $2.00.

This is an excellent guidebook, enhanced by many excellent photographs. Those who have visited the Capital City will enjoy the reliving of their visit; those who have never been there will obtain an impression that will thrill them with pride, especially in these days of 1940. Truly Washington is the most thrilling to visit of all cities in America.

The contents and illustrations are divided into the following divisions: (1) Washington: The Planner, the Plan and Its Evolution, (2) Government: the Capitol, the White House, the Departments and Independent Agencies, (3) Embassies, (4) Shrines and Monuments, (5) Historic Houses, (6) Churches, (7) Museums, Libraries, Galleries and Learned Societies, (8) Organizations, International and National, (9) Festivals and Scenes, (10) Environs: Arlington, Mount Vernon, Alexandria, Virginia, and (1) Outline Tours in Washington and Vicinity.

The excellent information included in this album of the nation's capital makes this one of the very best supplementary books for geography classes to be had. The reviewer can recall only one other book that would serve this purpose better—that is—if the purpose is to show America as it really is, a country unexcelled with its many beauty spots here, there, and everywhere.

—C.M.P.

BROWN, ROLLO WALTER. *I Travel by Train.* New York: D. Appleton-Century Company, 1939. 317 p. $3.00.

The author has travelled by train to practically every section of the country—large cities, small towns, rural sections, out-of-the-way places. In this book he tells about his experiences with all sorts of people—their problems, their joys and sorrows, what they really think. The author makes his fellow-travellers and the people whom

he meets real. This is a close-up of the crossroads of America.

I Travel by Train is a delightful book for anyone to read and a valuable supplementary book for geography. It isn't the type of book you are likely to read and then soon forget.

—C.M.P.

EASTMAN, FRED. *Men of Power*, Volume Four. Nashville: Cokesbury Press, 1939. 220 p. $1.50.

This is volume four of a series of Sixty-Minute Biographies published by the author. In each issue there are four biographies given. In this issue biographies of Abraham Lincoln, Leo Tolstoy, Graham Taylor and John Burroughs are given. The book is written in a most interesting style. Scientists might be interested in knowing volume one contains a biography of Pasteur; volume two Leonardo Da Vinci, and volume three, Charles Darwin.

All biographies are excellently done—brief, but fascinating. The author attempts to analyze the sources of power in the man's leadership. For example, what really made Burroughs an outstanding naturalist? According to the author, the source of power of the dweller of "Slabsides" and "Woodchuck Lodge" came "when he disciplined his spirit to understand, and his homemade pen to write, the message he heard for human life in the heart of nature." This is an excellent biography for students in biology.

—C.M.P.

ADAMS, GRACE. *Workers on Relief*. New Haven: Yale University Press, 1939. 344 p. $3.00.

Miss Adams, writing as a trained psychologist, answers numerous questions about work relief, the kind of tasks people are assigned to, how much they are paid, the conditions under which they work, and the effect of these years of "work relief" upon their morale and character. It is an explanation of the theory behind the WPA and why, how and where it first came into existence. She traces the experiences of individuals, who were on relief or WPA for a number of years—in a few instances for as long as nine years.

The author comes to no definite conclusions as to the desirability of work relief. Various authorities say that the efficiency of WPA labor is about 60 per cent—may be as low as 20 per cent and as high as 70 per cent. Certainly WPA is disgusting both to those on the inside who are workers on relief and those on the outside who pay the bills.

—C.M.P.

STUBBINGS, G. W. *The Diseases of Electrical Machinery*. New York: The Chemical Publishing Company of New York, 1939. 219 p. $3.00.

The Diseases of Electrical Machinery is the sort of book used by the practical man. As is stated by the publisher, the book is intended "to make as clear as possible the underlying causes of defects in electrical machinery." This book is far from being a complete treatise on the subject as can readily be seen from its size. There are few diagrams. The diagrams which are present are simple line drawings. The information contained in the book is written for the practical man rather than for the trained engineer. The book would be good to use as a reference, but would be of little use to the technically trained man.

—F. L. Herman.

WALLACH, M. U. *Pictures at Night*. New York: Knight Publishers, Inc., 1939. 41 p. $0.75.

This little handbook in the making of night pictures is written by one of the most advanced students of this art. Every phase of making pictures at night is covered briefly but to the point. Suggestions are included for finishing the film with specific developing formulas. This little work will be found a valuable addition to the library of the amateur photographer and offers some good pointers for the advanced amateur. The book is one of a series on photography by the same publisher.

—F. L. Herman.

LIVERIGHT, PAT. *Ideas into Pictures*. New York: Knight Publishers, Inc., 1939. 47 p. $0.75.

Ideas into Pictures is another member of the photographic library series by these publishers. It is written for the beginner and for the amateur. In a work of this size, only those ideas which the author has incorporated into his own works are given. Definite instructions and samples of pictures are given by way of illustration. All the points in making the final prints on enlargements are given. Because of its size, the scope of the work is limited. However the booklet will be found valuable for the amateur and may furnish new ideas for the advanced amateur in photography.

—F. L. Herman.

NEJELSKI, LEO. *The Camera Eye*. New York: Knight Publishers, Inc., 1939. 111 p. $1.50.

The enormous increase in popular interest in photography by individuals who are untrained in this field has lead to the publishing of many new books on the subject. This book is written for these individuals in order to acquaint them with the mechanics of the art. All subjects are treated in a brief, straight-forward manner. The English is simple and direct, so even the youngest photographer can readily comprehend the material. In a work of this size the scope is definitely limited. The subjects treated are the camera, light conditions, perspective, composition, selection of subjects, developing of films, making the prints and a small section on color photography. The

book will be of assistance to the amateur or the untrained person who contemplates taking up the art of photography in a serious manner. The book has many good illustrations of a good character.

—F. L. Herman.

PECK, A. P. *So You Want to Take Better Pictures.* New York: Scientific American Publishing Company, 1939. 209 p. $2.00.

The author states "that this book is a manual for those who own a camera." The writing is done in the usual form found in *The Scientific American.* The language is clear and easily understood. The subjects are covered very well without the technical phases of the materials being used. It appears as though one of the aims is to paint an accurate picture of the camera and its uses without confusing the beginner. This is truly a book for the novice and should not be used as a guide by the more experienced photographer although the trained individual will find many ideas and much helpful information. The book will serve as a good reference for most any student but as mentioned, it is written for the beginner.

—F. L. Herman.

STRONG, JOHN. *Procedures in Experimental Physics.* New York: Prentice-Hall, Inc., 1938. 642 p. $5.00.

Procedures in Experimental Physics was written in collaboration with Drs. H. Victor Neher, Albert E. Whitford, C. Hawley Cartwright and Roger Hayward. This book brings together for the first time many of the designs and techniques used in the building of apparatus for the experimental physicist and for the use of the research physicist. The book should prove to be a valuable aid to those who are unfamiliar with these techniques and to those who need a speedy ready reference to such material. The specific directions to be followed are clearly explained making them easy to follow. There are ample illustrations of the steps necessary to a successful conclusion of a desired procedure. The language used is simple, clear and direct. The procedures explained in the book not only give useful information but will serve as a basis upon which other techniques may be developed. There has been a need for such a book for a long time. This book will be found to fill this need adequately. A partial list of some of the subjects covered is: laboratory glass blowing, optical work, high vacuum technique, coating of surfaces, electrometers, Geiger counters, optics, photography, high temperatures and others. This book will be found to be a valuable one to have in the reference library or other libraries where it is readily obtainable. The book does not profess to cover the field completely so there are many techniques used by other workers which have been omitted. In any book of this kind there must be a limit to the amount and kind of material covered. It is in the wise choice of the material treated that makes this work of special value.

—F. L. Herman.

HOOTON, EARNEST A. *Crime and the Man.* Cambridge, Mass: Harvard University Press, 1939. 403 p. $3.75.

This volume gives a non-technical summary of twelve years of anthropological study of some 17,000 individuals including American criminals, insane and normal civilians, the latter as a background for comparison. A three-volume technical monograph giving the tabulated data in detail is also published by Harvard University Press. Professor Hooton's abundant data show that not only are the criminals and insane marked by characteristic degenerate physical features but that each type of crime, and of insanity, manifests its own abnormalities. The data of Lombroso and his followers were inconclusive because they did not take into consideration racial differences nor did they have modern techniques of statistical analysis. The data here summarized seem both adequate and well handled. They are made graphic by clever drawings—what the author calls "the adolescent vice of drawing bad pictures."

"Human evolution and cultural progress are blocked by man's insistence upon a status 'a little lower than the angels' instead of a little higher than the apes. We have perversely refused to learn from organic evolution that animal behavior arises from the organism itself and that progress and improvement in behavior can be effected permanently only by raising the quality of that organism." (p. 370.)

"We can direct and control the progress of human evolution by breeding better types and by the ruthless elimination of inferior types, if only we are willing to found and to practice a science of human genetics."

The book is a very valuable contribution to the problem of human betterment. The author's sense of humor makes it easy to read. Fascism and communism are, he thinks, danger signals that we have already let the nitwits and criminals breed so rapidly that they threaten to swamp civilization. Only prompt and heroic measures can save us from complete degeneracy.

—E.R.D.

THORNDIKE, EDWARD L. *Education as Cause and as Symptom.* New York: The Macmillan Company, 1939. 92 p. $1.25.

In how far is education a cause of the good things of life? Such things as the following are among the "good things":—a low infant death rate, a low mortality of mothers at childbirth, a high per capita expenditure for schools, for libraries, for recreational facilities, a small percentage of children working for wage, a high

percentage of home ownership, of telephone service, a low illiteracy and of automobile accidents. Good people like to live in communities where such things exist. Thirty-six such items make up the author's G score of a state or city.

An educational score (E score) is made up of several such items as per cent of residents 5–20 years of age enrolled in schools, public school expenditure per pupil enrolled for teaching and supervision, number of days the schools for white pupils were in session during the year.

By a statistical method of "analysis of multiple correlation and path coefficients" it is possible to determine in how far the E score is a probable cause of the G score, that is, how far the education of children in, say 1900, in a state or city is the cause of the good things of life enjoyed by the people of that community in 1930. Thorndike concludes from his data of a study of 48 states and 142 cities that education's share in producing the good things of life is about 20 per cent, a figure considerably lower than that of Bagley's study fourteen years ago.

—E.R.D.

BRYSON, LYMAN. *Which Way America?* New York: Macmillan Company, 1939. 113 p. $0.60.

This little book attempts to make clear to the lay reader the meanings and implications of communism, fascism, and democracy as ideologies and as governmental forms. Quite evidently he discusses these from the standpoint of the citizen of the United States who ponders the problems which face us as a nation and tries to decide the best plans of procedure which should be followed if our way of life here is to be improved.

The first discussion is on, "Your Battle." This is followed by discussions of, "The Russian Plan"; "The Italian Plan"; "The German Plan"; and "The American Plan." The final discussion concerns, "Can We Keep It from Happening Here?"

The differences in the several plans are introduced about Lincoln's statement of our democratic government which is "of the people, by the people, and for the people" and the attitudes of communists, Italian fascists, and German fascists toward that statement. In the several discussions the varied forms of control are made clear by giving pictures of the genesis of each movement.

The language is very simple and the ideas and concepts clearly put. I haven't come across any book in this field which give such a simple and yet understandable description of the governments of these countries in which we are now so intensely interested.

—A.W.H.

NEURAH, OTTO. *Compton Pictographs.* Chicago: F. E. Compton and Company, 1939. 25 p. Free.

This is a reprint of certain pages from the *Pictured Encyclopaedia.* The material is on the topic "How Machines Changed Man's Way of Living." Many striking pictographs are used in presenting statistical data, e.g., movement of population from country to city, work and leisure per week in U. S. manufacturing industries, man labor per acre, annual crop production, and so on. Science teachers will find some useful and interesting information in this pamphlet.

—C.M.P.

MILLER, WILLIAM J. *Elements of Geology.* New York: D. Van Nostrand Company, 1939. 505 p. $3.50.

The first edition of this text was published as an abridgement of the author's two volume work on physical and historical geology. It is designed for a one semester introduction to geology and does not require other sciences as background. The revision has moved material on instability of the earth's crust forward to the second chapter, where it better serves as an introduction to more specific applications. Descriptions of common minerals have been reduced. The chapter on the sea and its work has been almost completely rewritten. Changes in organization of Archeozoic, Proterozoic and Cenozoic eras have been made in the light of recent advances. These changes markedly strengthen an already excellent text.

—O. E. Underhill.

TOWNE, CHARLES HANSON. *Jogging Around New England.* New York: D. Appleton-Century Company, 1939. 205 p. $2.50.

The author, a poet, editor and novelist, has produced what may be considered either as a charming picture of New England beauty; its people, its past and its present, or as a guide book for the traveler in this region. It is a detailed account of a five-week trip by car through New England. It was like meeting an old friend, to the reviewer, who has lived all but five years of his life in New England, has resided in Maine, Rhode Island, Massachusetts and Connecticut, has visited many of the places, and has had similar experiences to those told about in this book.

—O. E. Underhill.

MILLER, FRED F. *Progressive Problems in Physics.* Boston: D. C. Heath and Company, 1939. 227 p. $1.32.

A revised edition of a work that is an old stand-by to high school teachers of physics. There are 1,237 graded problems plus enough supplementary ones on metric system, roots and volumes, and so on to make a grand total of 1,371. College Entrance Boards and the New York State Regents examinations for 1936, 1937 and 1938 are included. The appendix contains conversion tables, physical constants, squares, square roots and reciprocal tables, and a four place log table.

—O. E. Underhill.